POPULAR AVIATION

A Magazine for the Promotion of Amateur Aviation and Private Flying

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Why America is a Fifth Rate Air Power

Illustrated by Herman R. Bollin

By WALTER W. LIGGETT*

This is the first of a series of articles by Mr. Liggett in which sensational revelations are made. Not the least of these startling facts is the reason why the United States stands fifth in the list of nations as an air power.

"MILLIONS for defense but not one cent for tribute," was the soul-stirring slogan that roused every local American during one of the most crucial moments in our country's youth.

Today is another critical period in world history, when a blundering foreign policy has made us many enemies. We are still perfectly willing to spend millions for defense, but we are also paying a heavy tribute.

This tribute is exacted by selfish, short-sighted politicians, greedy contractors, and many other leeches on the body politic who are treasonably profiteering out of preparedness.

Since the World War ended, the United States Congress has appropriated more than $20,500,000,000 for the purposes of national defense. This money has been expended under the direction of the War and Navy Departments. During the same fourteen year post-war period more than $1,000,000,000 has been appropriated by Congress exclusively for the development of aviation.

Despite the expenditure of these staggering sums, our whole national defense was never in a more disorganized or chaotic state, and General William Mitchell recently characterized the existing Army Air Service as 'disgraceful" in its miserable inefficiency.

Bureaucratic red tape; the traditional hide-bound conservatism of the military caste; petty jealousies between the Army and Navy general staff, their

* Mr. Liggett is a special investigator retained by and sent to Washington, D. C., by POPULAR AVIATION.

mutual fear of being outshadowed by airmen and the unavoidable waste entailed by a duplication, are some of the reasons why the United States has dropped to fifth place among the nations of the world in flying power.

Even more injurious to the cause of aviation than the egregiousness of the Army and Navy general staff is the existence in our national capital of a powerful and well organized lobby, which perverts our military appropriations by urging the retention of obsolete coast guard fortifications, the maintenance of out-of-the-way Army posts; or the spending of hundreds of millions of dollars for questionable battleships.

Former officials, lame-duck Congressmen, retired Army and Navy officers, political go-betweens and others, are constantly patrolling the corridors of the House and Senate office buildings or button-holing Congressmen in the Capitol itself, while they try to influence legislation or to secure special favors for themselves or their friends.

Unfortunately, these privilege hunters seem to be the beneficiaries of an apparently deliberate policy by certain highly placed governmental heads, who display marked favoritism in the purchase of equipment, munitions and supplies.

THE lobbyists do not confine their operations to military aviation. The allottment of contracts for carrying air mail seems to be governed by the same gross unfairness. As a result of this log rolling, a few favored firms are prospering, although the industry as a whole suffers.

And this situation is allowed to grow from bad to worse because the average Congressman is too apathetic to investigate the facts, or too timorous to "stir up a mess" which may reflect upon his party leaders.

Consequently, we have a situation in Washington today, so far as it relates to national defense, which simply must appall any honest American who loves his country or is solicitous for its future welfare.

The mere spending of more money will not remedy the situation. We already devote too great a proportion of our national income for military purposes—but we spend it unwisely and on archaic methods of defense.

Many, many millions are spent annually upon stationary coast guard defenses, calvary organizations, and upon costly battleships which Admiral Fiske once declared "would be forced to take refuge up the Mississippi river in the next war".

The air service is neglected and we cannot teach young men to fly because we lack the necessary training planes. Even today, after military appropriations have been reduced under the plea of economy, we are spending more than $750,000,000 annually for national defense.

Such experts as General Mitchell, Major Edward Rickenbacker, Congressman LaGuardia and scores of others are agreed that an annual expenditure of $75,000,000—wisely directed—would give the United States a flying force of 2,400 fighting planes which would make it absolutely impregnable from attacks by land, water or air.

Primarily, the fault for the comparatively undeveloped state of our air defense lies in the fact that its functions have been divided between the Army and Navy.

Both of these departments not only have utterly failed to see the possibilities for aviation as an independent instrument of war, but have insisted upon subordinating our aeronautical organization to their own special activities on land and on sea.

Consequently, aviation has been kept in leading strings by generals and admirals who refused to recognize this new fourth dimensional phase of modern warfare.

UNIFICATION of the Air Service is the first necessary step towards the accomplishment of a real preparedness program in the United States—and let me emphasize once more that we can have no preparedness until we are at least upon a parity with other nations so far as concerns air power.

Practically every unprejudiced person who has studied the situation comes to the conclusion that our air forces will not be developed properly until they are taken away from the Army and Navy and united under a single command. Most students of the subject go even further by declaring that not only should the Air Service be unified, but that the separate War and Navy establishments be abolished and all branches of our military service placed under the control of a newly created Department of National Defense.

A single Department of National Defense, with sub-divisions for the Air Service, Army, and Navy, through its unity of command, would harmonize our national defense system, reduce expenditures for equipment and supplies, prevent needless duplications, lessen the existing jealousy and friction between our different military arms, and provide a uniform and equalized system of pay, promotion and retirement. It also would greatly decrease the overhead cost of maintenance and cut down the number of bureaus within the departments.

Duplication, unavoidable when the Air Service is divided between the Army and Navy, has a peculiarly retarding effect upon the development of aviation. Jealousy of Army and Navy general staff heads has tended to limit the amounts asked for from Congress, and instead of being used to purchase planes and train flyers, an unduly large proportion of this money has been spent in overlapping efforts. For instance, both Army and Navy maintain separate flying fields, yet in several instances their airports are located within gunshot of each other.

ONE field and one personnel would be sufficient to accommodate all the Army and Navy planes in a given locality, yet under the existing system, money that should be spent in developing the industry is used in maintaining wholly superfluous fields. At the present time, the Army has nearly $100,000,000 invested in flying fields and the Navy has close to $70,000,000 tied up in landing bases.

It has been estimated that at least $50,000,000 of this money could have been saved by a little co-ordination between the Departments of War and Navy. Traditional jealousy, however, has prevented any steps looking to the prevention of this flagrant waste. This fifty million dollars would give Uncle Sam one of the finest flying fleets in the world.

The same needless waste results from the separate research and experimental bureaus conducted by both Army and Navy airmen. So far back as 1919, the American Aviation Commission, headed by Benedict Crowell, assistant Secretary of War, and composed of numerous army officers and manufacturers, which was sent to Europe to

+ + +

In cutting up the appropriation pie for our national defenses why do the Army and Navy receive a full ninety percent for their own devices while poor little Aviation, the modern backbone of the defense, receives only a paltry ten percent?

+ + +

Our air forces should be an independent department, on a parity with the Army and Navy and provided with an adequate appropriation.

+ + +

report on air progress, recommended "that all technical functions in respect to aeronautics be centered in a single technical division which shall perform the work for the Army, Navy and civil aviation; and which shall be headed by a civilian.

Millions of dollars would have been saved if this sensible recommendation of thirteen years ago had been adopted. But once more the idiotic jealousy between Army and Navy officials cost the taxpayers dearly. Generals who had never flown in a plane and admirals who didn't know the difference between a fuselage or a super-charger, glared at each other across Congressional committee rooms while they solemnly assured our law givers that such an arrangement would be absolutely impossible.

And Congress, always too willing, unfortunately, to accept the assurance of some bureaucrat without going to the trouble of an independent investigation, was too indifferent to compel this combination.

They always are ready to "double-team" on Congress, and unless one has spent years at Washington, studying at close range the complicated machinery of government, it is simply impossible to understand the tremendous pressure which the military clique can bring to bear.

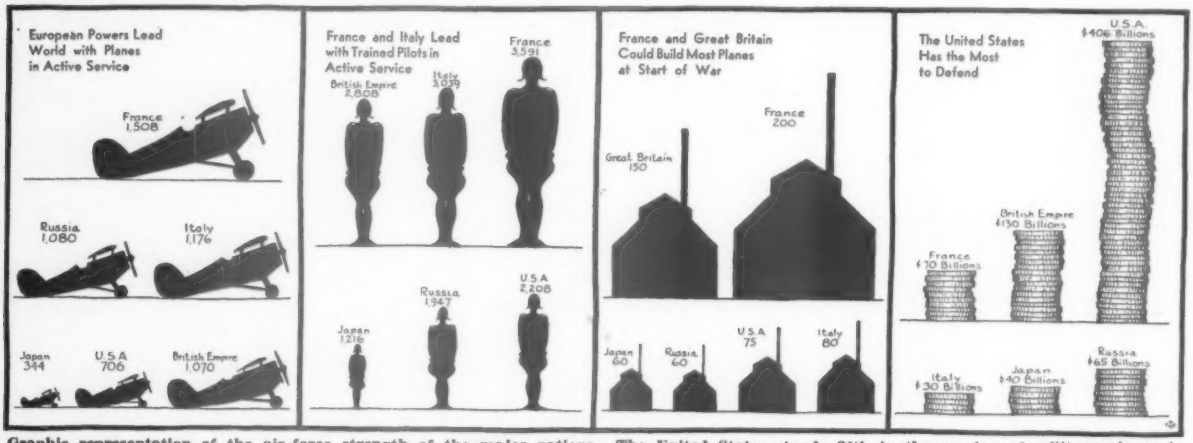
Several thousand Army and Navy officers — and their wives — reside in Washington. Socially they outrank the Congressmen, many of whom are just poor boys from the country trying to get along. Most of the exclusive Washington clubs are controlled by the Army-Navy clique. If any Congressman—or his wife—has social aspirations in Washington, it simply won't do to offend the Army-Navy set. Knowing perfectly well that politicians set a high value on social recognition, the military crowd plays this social game with diabolical skill.

Many a Congressman has changed his vote on some military appropriation bill merely because his wife came to him, in tears after she heard she wasn't

Year after year, Congress hears the same pleas for a unified air service—and year after year, bills intended to establish a Department of National Defense, where aviation will be on a parity with the Army and Navy, are quietly smothered in committee. It is discouraging; yet the few men who scorn pork-barrel politics, and place their country's welfare above petty, personal social recognition, continue their uphill fight.

The first bill providing for unified air service was introduced in 1919 by Charles F. Curry, Sr., of the Third District of California. Never daunted when committees failed to report, or reported adversely, Mr. Curry reintroduced the bill in varying forms in every successive Congress. In 1930 the elder Curry, then chairman of the House committee on territories, suddenly died.

His son, Charles F. Curry, Jr., who had been his father's secretary for eleven years, filed for the nomination and was elected by an overwhelming majority, although the voters had to



Graphic representation of the air-force strength of the major nations. The United States stands fifth in the number of military planes in active service, and fourth in all other respects. France stands supreme in the air by a wide margin. At the same time, the United States has more money to defend than all of the other nations together. Figures are for 1930.

IT IS extremely difficult to compute just how many millions have been wasted by this wholly unnecessary duplication in research and experimentation. The hearings held before the select House committee, headed by Congressman Florian Lampert, in 1924-25, brought out that the Army had been spending more than $4,200,000 a year for experimentation, while the Navy was spending approximately $2,500,000 annually along research lines.

The Lampert committee, incidentally—and its report was filed in 1925—unanimously recommended "That there be established a single department of national defense, headed by a civilian secretary, especially charged with the co-ordination of the defenses of the country."

Ordinarily, as I have already indicated, Army and Navy Officers are about as congenial as strange cats and dogs, but they have a strong feeling of caste. Whenever they feel their military perogatives are being imperiled, they quickly drop their jealousies to unite against a common foe.

going to get an invitation to Mrs. General So-and-So's reception. Many another vote has been changed because the Congressman himself had an application pending at some country club and feared a military blackball.

THAT men elected to Congress to carry on the nation's affairs should allow themselves to be bamboozled by this silly side show almost makes one despair for democracy. Nevertheless, this social lobby, as differentiated from the Anti-Saloon League lobby, the manufacturers' tariff lobby, the labor lobby, the farmer lobby and the hundred other lobbies that make business continuously good for the Washington hotels, is one of the most potent organizations in the capital.

A well known progressive senator once said, "If I had the power, I would pass a resolution that no Army or Navy officers, not on active duty, could live within fifty miles of Washington or visit it without special permission from Congress. Then we might have a sane preparedness program."

write in his name. Curry, who served in the Air Service of the American Expeditionary Forces during the World War, and who is captain in the Air Corps Reserve, has reintroduced, slightly amended, the old measure.

It is now on the calendar as House Bill 261, and hearings on it will be held by the House Committee on Military affairs before the present session expires. It will have many strong supporters. More and more Congressmen are coming to feel the Army and Navy have been allowed to ham-string our aviation program long enough.

GENERAL "BILLY" MITCHELL, who virtually was kicked out of the Army because he refused to "take program" and insisted upon the necessity for a separate air service, is still patriotically devoting almost his entire time to the development of military aviation. He spends innumerable hours conferring with individual Congressmen, or appearing before committees, and on every possible occasion he boldly broadcasts the truth about the "brass hats"

in the Army and Navy high command who are so stubbornly handicapping our air preparedness program. General Mitchell remarks:

"The mission of air power should be the responsibility for the complete air defense of the whole United States. Without a mission of this kind being specifically provided, the aeronautical effort of the country will be so dissipated between land, water and other services, that maximum efficiency cannot be obtained. That has been proved everywhere in every operation.

"All of the great countries of the world are now organizing their air power for striking their adversaries as far away from their own countries as possible, whether the enemy be in the air, on the water, or on the land. This policy is adopted so as to make the home country free from the interference of hostile forces by keeping the fighting at a distance from its frontiers or coasts. In other words, our whole idea of national defense is to keep the enemy from the country, and if the national defense does not do this it is not what it should be.

"Air power is the most rapidly developing element in the make-up of nations. Accurate vision is required to keep abreast of the times, and progress must be adopted on the basis of what will happen from seven to ten years hence. Failure to estimate properly what will happen may have serious consequences in case of war.

"At the present time, our air activities are distributed between a great many different departments of the government, none of which has aviation as its main function. Consequently, aviation receives a secondary consideration in each case. You Congressmen bring the Navy officers up here and they argue battleships to you and tell you what aviation cannot do. If you bring the Army here, they see the need of aviation to a much greater extent than the Navy does, but they also tell you what it can not do. Now, we want an air department that will tell you what it can do, and which will have direct access to you without going through the heads of other services.

"We want to have an air service that will unify all the overhead, where at present there is a duplication between the Army and Navy and other services. We want to make all our production come from the same place, to meet the mission that an air force is destined to carry out, and we want the land air service organized according to a definite plan so it can be used any place that is necessary and we want to organize and to encourage our commercial and civil aviation.

"Since the World War we have put hundreds of millions of dollars into our air development and we have very little to show for it, comparatively. With far less expenditure per year than we now have, we could have a very efficient air force and probably be

(Continued on page 257)

SIGN THIS PETITION AT ONCE

Do your part in building up our inadequate and depleted air forces by signing the petition below, and have your friends sign with you. Do this at once—don't delay.

This movement has met with the enthusiastic endorsement of our readers, more than 1,500 names being received on the last petitions printed in the March issue. As many as fifty names were attached to some of the petitions.

To establish America, "first in the air", is our patriotic duty. By the organization of a civilian air force to meet wartime demands, POPULAR AVIATION believes that it has found a solution for the vexatious problems now facing this government. Cut off coupon below along dotted line. Do not include part in italics.

POPULAR AVIATION

PETITION

for

Free Civilian Training

We, the undersigned, petition the United States Government in the interests of National Defense:

(1) To refuse any further appropriations for the purchase of airplanes or airships which are designed for limited production at high prices—

(2) To organize a Free Civilian Training Plan by which boys and young men can be given flight training for future military service, should the necessity arise for their service—

(3) To encourage the mass production of popular type aircraft, trainers, and military types, of low cost and suited to the equipment and capacity of all aircraft manufacturing plants—

(1) *Name*.....

Street or R. F. D......

City.....*State*.....

(2) *Name*.....

Street or R. F. D......

City.....*State*.....

(3) *Name*.....

Street or R. F. D......

City.....*State*.....

(4) *Name*.....

Street or R. F. D......

City.....*State*.....

(5) *Name*.....

Street or R. F. D......

City.....*State*.....

(6) *Name*.....

Street or R. F. D......

City.....*State*.....

NOTICE Additional names and addresses may be written on an attached sheet—PASTED to this petition. Direct the petition to—JOHN B. RATHBUN, *Managing Editor*, POPULAR AVIATION, 608 S. Dearborn St., Chicago, Ill.

Increases Speed by Means of a Turbo-Supercharger

Showing the supercharger, with its connections, at the right side of the engine.

CAPTAIN RUEBEN C. MOFFETT is stationed at Wright Field, Dayton, Ohio. Last January he flew from his home field to Bolling Field, Washington, D. C., in one hour and twenty-six minutes, at an average speed of 266 m. p. h. He set a new time record for the trip.

The photograph shows the captain standing beside the pursuit plane in which he made the flight. He is pointing to the turbo-exhaust driven supercharger which made it possible for the 600 h. p. engine to operate at the altitude of 25,000 feet, the elevation at which he flew.

The Fairey All-Purpose Military Airplane

THE Fairey III-F is one adopted as a standard for the Royal Air Force. The type III-F is adapted for many different uses, the chief difference being in the cockpit arrangement.

One of the several arrangements is known as the Fairey III-F-All Purpose plane. It is the two seater illustrated here.

Among its special features is the slotted leading edge, specially constructed cushion shock absorbers on the landing gear, and the arrangement of the supports to take a great variety of engines.

The Fairey Aviation Company is one of the leading manufacturers in England. In addition to their manufacturing plant, and to cope with the technical aspects of aircraft development, they have a large experimental department.

The trim lines of the Fairey All-Purpose plane, a noteworthy English production.

Dicky Phelan

By LIEUT. RICHARDSON

DICKY PHELAN joined the 213th Squadron of the Third Pursuit Group in time to participate in the St. Mihiel drive.

For the first time the American fliers seemed to be overcoming the handicap of lack of equipment, or second-rate equipment, with the result that air battles on a grand scale known as dog-fights become more frequent and more intense. It was Dicky's luck to join in two of these dog-fights during his first ten days at the front. Out of them he came unscathed and with a victory to his credit.

And then came the episode in Dicky's career which was superlatively dramatic and stands out as a unique incident of the World War. Moreover, it earned him the right to stand shoulder to shoulder with all men of flaming courage, none excepted.

Dicky's flight was scheduled for an early patrol one morning. In perfect order they climbed from the airdrome and headed into the sun, just a giant orange ball through the wisps of ground mist.

Above, conditions for flying were ideal. The sky was cloudless, the visibility was faultless. Occasionally wings flashed in the distance like a brilliant day star. The Americans were anxious and searched the heavens intently. Death lurked in serene skies these early autumn days, exacting a fearful toll.

It happened suddenly as things so often happen in the air. A flight of Fokkers appeared as if by magic and a desperate dog-fight ensued. With unusual skill and aggressiveness Dicky quickly maneuvered into position behind one of the Fokkers. He, in turn, became the target of another German pilot, who dived in behind him and punctured his plane with deadly machine gun fire.

One of the bullets—probably explosive—set the gasoline tank of Dicky's plane on fire, and almost instantly the flame and smoke shot out to warn him of his frightful fate. Fire was the thing every airman dreaded most. It was speedy in its work of destruction, and escapes from burning planes were miraculous, for no American airman carried a parachute.

What did Dicky do in that fleeting moment that stood between him and eternity? He accepted his fate calmly and decided to make the most of his time. Not even smoke and fire triumphed over his cool courage. Enveloped in flames, he dived and maneuvered his machine into position behind another Fokker and shot it down.

The history of our air service reveals no more thrilling example of supreme pluck. Nor does it reveal many instances of another thing that happened: in maneuvering his machine to

(*Continued on page* 255)

An Open Letter to E. L. Cord

In which POPULAR AVIATION points out why the present lock-out of the Pilots on the Century Air Lines is a menace to commercial aviation

Mr. E. L. Cord., Pres.,
Century Air Lines, Inc.,
Chicago, Ill.

Dear Mr. Cord:

Up to a very recent date we have viewed your activities in aeronautics with great admiration and satisfaction. You have done much to advance aviation, both within the industry itself and in making aviation popular with the general public.

Largely through your efforts, the cost of air transportation was brought down within the reach of the average man. You made a drastic cut in the price of airplanes, speeded operations, introduced faster schedules, provided better terminal facilities, and in many other ways have been of real assistance to aviation.

But, Mr. Cord, as a publication dedicated to the interests of aviation, we find it necessary to debate certain tactics that you have seen fit to pursue within the past few weeks. In short, we deplore your attitude toward your pilots and the conditions that this attitude has brought about in the aviation world.

We have witnessed, by your acts, twenty-one of the best and most highly regarded pilots in this country suddenly dismissed from the Century Lines. We have been informed that these pilots have been "locked out" summarily as a result of their objection to a 40% wage cut. As this is an act that threatens the welfare and progress of aviation basically, and tends toward lower standards in the industry, we would be neglectful of our duty if we did not raise our voices in protest.

We are not alone in our belief that the Century Air Lines have perpetrated a wrong upon these pilots. That this has become a national view is proved by the flood of telegrams that have come pouring in, sympathizing with the locked out pilots.

The "picket" plane used by the pilots in protesting their grievances against the Century Air Lines.

Portrait of E. L. Cord, president of the Century Air Lines, to whom this letter is addressed.

Representative Maas, Republican, of Minnesota, sums up the situation in a nutshell in his telegram to you:

"I have taken an active part trying to build up commercial aviation. Many members of Congress join me in feeling that the manner of handling dispute the pilots of Century Air Lines most unfortunate to whole field of aviation, particularly traveling public. To reduce pay of pilots below decent living standard will destroy public confidence in air travel and defeat its own purpose. Any airline unable to operate and pay decent scale and maintain competent standard of pilots is not justified in operating at all. If you can't afford to operate on a fair safe basis I suggest that you leave the air transport field to those who can."

And this, Mr. Cord, is exactly our opinion. What Representative Maas says in this telegram concerning a "decent living wage" and "destroying public confidence in air travel", is particularly significant. Nobody wishes to ride on an air line when he knows that the pilot is dissatisfied with his pay. It isn't safe. And, further, Mr. Cord, the public will not ride with "scabs" and "short-time" men, picked up with a view of cutting down operating costs.

Heretofore, your pilots were averaging about $410.00 per month—a $350.00 flat salary plus a $25.00 raise and $5.00 per hour for flying on "days off". They are now being ordered to accept $3.00 per hour for day flying and $5.00 per hour for night flying with a flat guarantee of a minimum of $150.00 per month. It is estimated by the pilots that their new wage scale would average around $225.00 per month—more than a 40% cut from their previous salaries.

It is hardly good business to trust a $150.00 a month man with a $30,000

Group picture of the pilots locked-out by the Century Air Lines—men thoroughly experienced and capable.

to $60,000 airplane and a cargo of 12 or more priceless passengers.

Perhaps it is true that a pilot is no superman. Perhaps it is true that no genius is required in flying an airplane. But it is true, that the pilot is captain and master of his ship in midair. In the event of an unforeseen emergency, the high qualities of the plane, equipment and superior executives are of little aid. The pilot himself must face the emergency, relying primarily on his native abilities. He must rely on hair-trigger conclusions, unerring accuracy, perfect judgment. If he is only 99% right in his decision, he's lost.

Obviously, Mr. Cord, if the man piloting the machine through the air has no such native abilities, his ship and his cargo are in dire straits. It is too late then to change pilots, to replace the second rate man. And we might ask, who else but a third rate man will be attracted to $150.00 per month guarantee?

We don't want any more airline crashes—not if we can avoid them. And the employment of low-priced, second-rate commercial air pilots is a direct invitation to a series of air accidents that will put the aviation industry and air transportation where it was ten years ago.

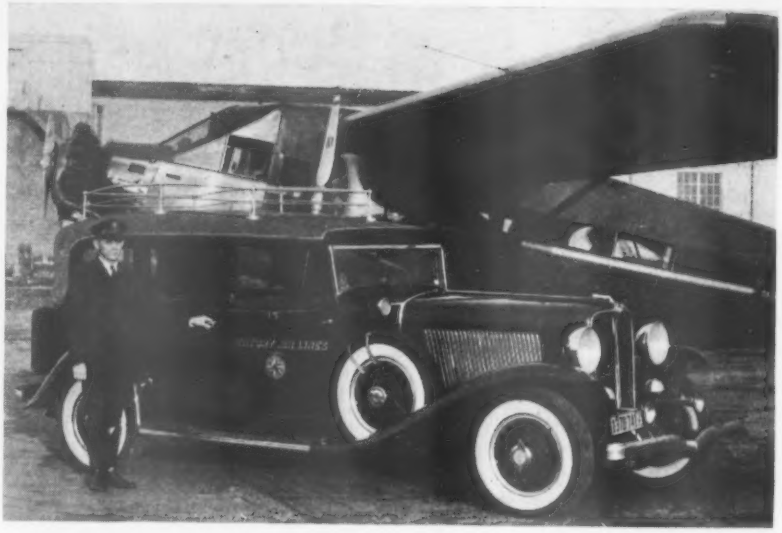
It has taken 20 years to drum the doctrine of safety into the minds of the traveling public. Must we go through all this again during another decade or two before we once more succeed in getting the traveling public to use the airplane again? Shall we jeopardize the many millions invested in the aviation industry for the paltry saving of $4,000 on the monthly payroll of Century Air Lines?

A wage reduction from $350.00 per month to a mere guarantee of $150.00 per month is a rank imposition on both the pilot and the air traveler. Even in an industry where the personal qualifications of the employes are less exacting, such a cut in the wage scale is absurd and unheard of.

As you undoubtedly know, Mr. Cord, a good pilot of the transport grade is a highly trained man, far above the average worker in the matter of intelligence and physical qualifications. His training alone represents an investment of about $5,000.00 on which he has a right to expect a reasonable return in addition to his ordinary monthly compensation. To lower the wages of such a man to the level with the wages commonly paid to unskilled labor is ruinous to the industry as well as to the personnel.

If such methods were to be followed by all the other air lines, Mr. Cord, just what inducements could be offered to young men to enter the pilot's profession? Do you believe that the prospect of receiving $150.00 per month would be a sufficient attraction to induce a young man of good character and attainments to undergo a strenuous training course and invest $5,000?

There is a certain parallel to be drawn between the present situation in aviation and the relations between the railroads and the Brotherhood of Locomotive Engineers. The locomotive engineer is comparable with the pilot in very many respects, and therefore we ask you, Mr. Cord, to look back into history and find just when the last strike of the locomotive engineers took place. You will find that the railroads learned their lesson many, many years ago, and that an active engineer's strike is almost out of the memory of the present generation.



A Century Air Line plane standing beside the special car used for transporting passengers to the field.

You will find that railway executives will cut the wages of porters, station masters, signalmen, trackmen, etc., but the wages of locomotive engineers are held intact. Sooner would executives cut their own salaries, or dividends, than tamper with the good will and quality of the men who "pilot" their trains.

When the pilots went to work for the Century Air Lines in March, 1930, they were promised a salary of $350.00 per month with a bonus of $100.00 per month for good performance. This bonus never materialized. However, as a compromise for the bonus, a raise of $25.00 per month was offered with each six months of service. This second increase in salary was due in March of this year.

Instead of the increase promised them, they got a wholesale notification that they were to get a reduction of $200.00, net, in their salary. And, nothing further was said about the remaining bonus of $25.00. As a business man, Mr. Cord, do you believe that this sort of treatment is fair or even safe?

With good luck and steady flying your pilots were given the opportunity of earning around $225.00 per month—which is over 40% less than they had been earning one month previous!

To the date of going to press, none of the pilots have handed in their resignations, although twenty-one of the pilots received the following request for their resignations, couched in the following terms:

February 9, 1932.

Dear Sir:

Your resignation is accepted effective immediately. Upon turning in our property now in your possession to our Chicago office you will receive your pay check up to and including February tenth.

Century Air Lines, Inc.
By W. F. Bliss,
Assistant General Manager.

None of the pilots had previously signified any intention of resigning. They had simply refused to take a reduction from a base salary of $350.00 per month. And this is not an exorbitant nor an unreasonable salary for the services rendered by these men.

It should be noted, that the original agreement, made in 1930, was made in the active days of the depression, so that the present financial condition can hardly be advanced as a cause of this peculiar streak of economy. And will it prove economy in the long run, Mr. Cord, to experiment with a lot of irresponsible "strikebreakers" to take the place of men of proven merit?

No doubt your step was taken in an effort to cut costs in the interests of cheaper air transportation. An excellent idea, deserving full encouragement. But, for the sake of aviation and public policy make your salary cuts and savings where the least harm will result. Cut overpaid executives, eliminate ground pilots, cut dividends, join in a united ticket office—do anything except lower the caliber of our air pilots.

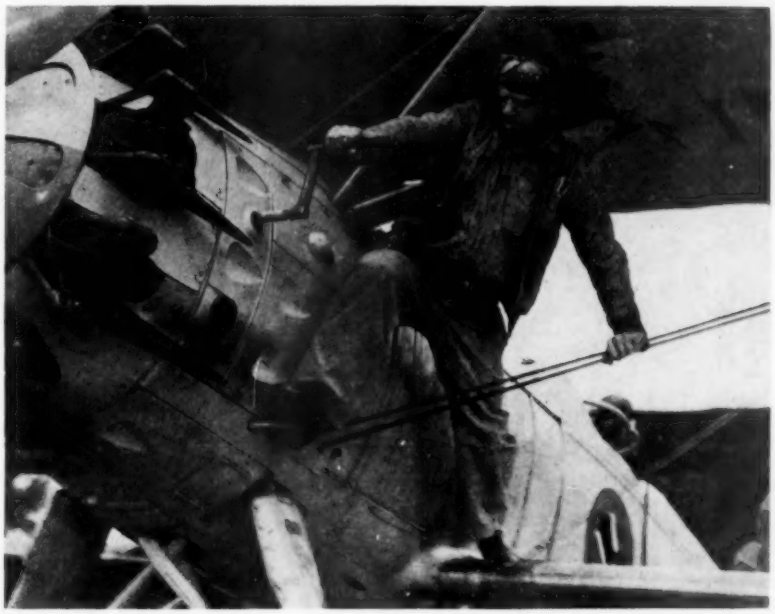
Have you considered the effect of this lock-out upon commercial aviation in general? It is our belief that it is one of the most important epochs in the industry that depends upon the outcome of the questions. If the pilots of the Century Air Lines are defeated in

(*Continued on page* 256)

Wallace Beery as an Airman

by LIEUT. HORACE MAZET

Did you know that Wally Beery carries a full transport pilot's license, and that this red-blooded he-man has run up his air-hours to a tremendous total? Lieut. Mazet gives as a most entertaining account of Wally's air activities.



Wallace Beery "winding-her-up" on a Navy Hell-Diver, a scene from the recent film "Hell-Divers".

IMAGINE, if you will, being taken up in a closed cabin plane and then being turned upside down while you grasp at thin air and wonder when you will ever get back to good old earth again—if ever! The chances are that you would be so confused that the world would seem quite topsy-turvy. It is not a treatment recommended for timid school teachers or poor sailors. But to Wallace Beery the situation is a cause for hearty chuckles.

"The funniest thing in the world," said this sportsman pilot, "is to take up a bunch of passengers for a ride in a

An intimate portrait of Wallace Beery in his flying togs—ready to go.

closed job—and then put her into a couple of tight loops. They don't know where they are!"

Yes, it is funny—to the pilot who knows what is going to happen next and if there is plenty of safe altitude below the stunting plane. But it is startling in any case to the passengers.

Wallace Beery was still chortling over the recollection of some recent guests who had involuntarily been baptized to stunting in his personal ship. And there are always plenty who like to ride with Beery despite his rough humor, for he is a fully accredited transport pilot, licensed by the U. S. Department of Commerce. In fact, Wally flies his plane himself from Hollywood to New York in preference to traveling on the more conventional train. It is so much quicker, cleaner and far more fun.

During rehearsals while the set was being prepared one day, Beery, George Hill, his director; Robert Montgomery and Chester Morris, all aviation enthusiasts, were swapping yarns. Hill had been telling about the time he flew as captain during the war and Wally was explaining how much better modern planes were.

"I remember the first time I saw a big Ford transport plane being tested," he recalled. "I'd gone to Detroit with some Maddux Line pilots—I was interested in the company at that time—to bring back a Ford airplane. It hadn't been tested and the pilot offered to take me up.

"I climbed in, unwittingly. What he did with that plane was to take her up about eight thousand feet, then dive straight at the ground, pulling out of the dive about a thousand feet. *Whew!* And that's a lot of weight to send through the air at about 250 miles per hour."

After the filming of "Hell Divers", Wally has really appreciated diving at full-gun to earth only to pull out at the last minute.

" 'What's the idea?' I asked him after we'd landed.

" 'Oh,' he replied, 'That's to see if the wings are as strong as they ought to be. If they'd collapsed, the plane would have been no good to send out for commercial work. We wouldn't have delivered it. Ford is particular about the wings in his jobs.' "

"Gosh," remarked Hill, "how did you feel?"

"Oh—all right," responded Beery. "I didn't realize what a dangerous job the Ford test pilots had until I thought it over afterwards. I wouldn't take that job on a bet. Still, it isn't any worse than those navy diving bombers."

HOW true he spoke, Wally found out when watching the trained naval aviators at North Beach, Cal., while filming his latest vehicle. The real difference lies in the fact that the Hell Diver planes are constructed specially for diving straight down at terrific velocity in mock attacks on a theoretical "enemy" on the surface.

And those navy boys certainly know how to handle the small speedy bombers if we may judge from the destruction of the targets in "Hell Divers". They are just blown to bits by an incessant rain of direct hits.

But Beery was speaking of his experiences in sport flying. "The most useless feeling I ever had was when I was flying in my own ship one day and was gliding in for a landing when the aileron cable broke. There I was, coming down without lateral control and couldn't do a darn thing."

"What happened?" asked Morris.

"Oh—made the landing all right by cutting the motor, but ripped up the

landing gear. The gang around the hangar kidded me a lot."

It probably didn't worry him much though. Beery is at home in the air. He is the ranking sportsman pilot in Hollywood, having owned three planes: an open three place job with a 300 h.p. Wright engine, and two identical closed cabin ships carrying six with the 450 h.p. Wasp engine and a top speed of 140 m.p.h.

His first plane he sold; the second was wrecked by his pilot in his absence. He is the only motion picture actor to hold the full transport rating, although there are several with the limited commercial and private ratings. He has been flying for almost three years.

As a matter of fact, it is difficult to keep Beery from "going up in the air". He calls flying his business and pictures his duty. After a hard day's work on pictures he invariably goes up into the air, turns the controls over to his pilot, goes into the after compartment and sleeps for several hours at a 5,000-foot altitude. He says he gets his greatest rest that way, lulled to sleep by the powerful explosions of the engine.

IN HIS aerial history, Wally has had anxious moments, too. He got his greatest thrill at the time when he was spinning earthward out of control from 16,500 feet over Medford, Oregon, and in that enemy of airmen—a dense fog. At a scant 200 feet, he saw the ground dimly through the thinning mists. Just as he recovered control from the spin, his engine died, whereupon plane and Wally came down directly into a field. He says he was lucky to get out alive.

Lucky is right—the experience serves him right for flying through a dense fog. What a danger such weather conditions impose on pilots is to be seen in Beery's emergency flight in "Hell Divers" when he pilots a small bomber with two seriously injured men aboard through an impenetrable fog to the deck of the "U. S. S. Saratoga" proceeding at sea. It is an impossible stunt, but of course, not to the movies.

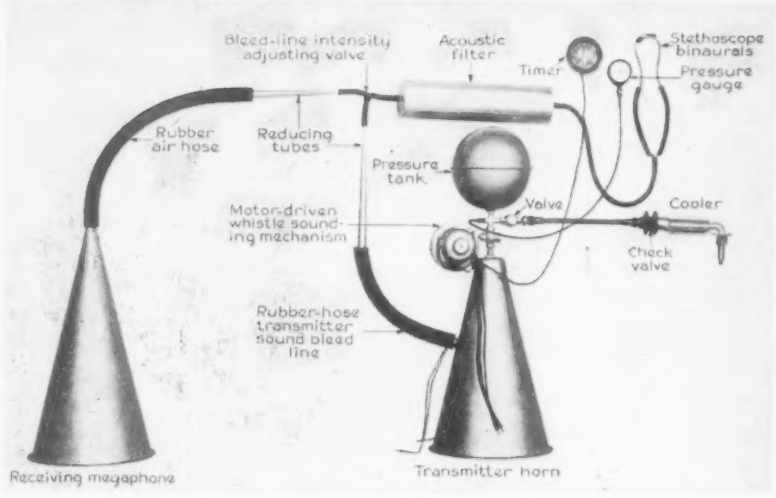
Beery's greatest worry occurred during the work on "The Big House" when an unfounded report came that his plane had cracked up at a nearby town. He knew that his wife had intended going aloft in that ship. He nearly went frantic until he located her several hours later at a friend's house.

On another occasion, his plane sprung a leak over the Utah desert—miles from his destination. He was forced down and in landing broke a strut on his landing gear. He was in a great hurry to get to Salt Lake City. So he took a chance, repaired the strut with baling wire from a nearby ranch and flew on safely. Shades of the old "haywire" flying days!

There is a regulation of the Department of Commerce that no pilot shall stunt nor fly his plane unnecessarily close to the ground. One day, when not working on "The Big House", Wally zoomed his plane close over the head of Director Hill. Hill (the old wag)

(*Continued on page* 263)

Principles of the Sonic Altimeter Explained



A schematic drawing of the Sonic Altimeter and its parts.

THE sonic altimeter offers a simple and reliable means of height indication by means of sound waves reflected from the ground. The source of sound is a compressed air whistle mounted in a megaphone which directs the signals downward from the aircraft. Short blasts are blown automatically, the timing being controlled by a rheostat.

The echo of the outgoing signal is received in a second megaphone which is connected through a high-pass filter to a stethoscope worn by the pilot. A timing device mounted on the instrument panel makes possible the indication of height above ground, the indicator being calibrated in feet rather than in intervals of time between the outgoing and incoming signals.

As the distance above ground is decreased, the interval between the transmitted signal and the echo received in the stethoscope becomes shorter and shorter until finally the ear is not able to distinguish between the two. At this point, the plane is within five to ten feet from the ground.

The sonic altimeter has been in practically continuous service since its development without showing any important mechanical or acoustical defects. The average of results by several listeners indicates that, with the motor running at cruising speed, reliable echoes are heard up to 800 ft. while, with the motor idling for a glide, reliable echoes are heard up to 1,400 ft.

Many blind landings have been made in which the blending of the outgoing signal and echo indicated an altitude of five ft. or less.

An advantage of the sonic altimeter is that it puts the ear to work and relieves the eye to watch the instruments and the ground. It is possible for a pilot to feel his way down through a fog or low clouds without danger of flying into the ground.

By its means, a pilot, over a dangerous terrain, can maintain a safe altitude, as the reliable signal height is adequate for safety.

Sheep as Lawnmowers at German Airport

Not so nice to land on!

THE German airport managers have become shepherds. No, it is not because meat is scarce, nor that business is so poor that they had to do something to maintain their income. Their sheep are used to keep the grass clipped on the landing field.

Sheep need lots of grass and in clipping it, they do not tear it as many animals do. Instead they bite it off short and do not injure the roots.

It is a large size task to cut the grass on a landing field by man power and very expensive. The sheep do the job well, and as they fatten on a grass diet, there is quite a profit when they are sold to the butcher.

Aviators have to be a little careful in landing, however. In a short time the sheep become very used to the planes and do not get out of their way. Just think of all the lamb chops and roasts that would be flying through the atmosphere if some big tri-motor job should plow through the ranks of the groundkeepers.

XUM

How Uncle Sam Handles Crashes

by T-2003

At the government fields, very complete equipment is provided for taking care of crashed ships and the wounded. "T-2003" gives us full details of this equipment and the rudiments of first aid methods.

"WHOO-EE-EE — Wham — Crash!"

One moment a proud ship of the skies—a ton or so of metal and fabric—held aloft by the force of the air and the skill of the pilot. Something goes wrong. Never mind what—it doesn't matter now. The next moment, to a crescendo of whistling wires, this proud ship has come to earth, suddenly, forcefully and with serious or fatal results.

Cold statistics tell us, and we all know, that the percentage of accidents is lower as the years go on; but still there's *more* flying done each year. There are *more* of us around airports each day, so there are just about the same total number of accidents as ever, but with more witnesses to each one.

Picture an accident yourself. Your first instinct is to up and run pell-mell for the scene of the wreck, isn't it? Why? To give aid to the occupants of the airplane? To get them out of the way of possible fire or to put out the fire which may have burst out an instant after the crash?

Oh, Yeah?

Put out the fire with what? Your bare hands or your heroic instinct? Give first-aid for what? How many of us have learned even the rudiments of first-aid, let alone the complete course such as the Boy Scout learns? And suppose there were a thousand of you with the same impulse of curiosity, for such it must be, all bent on making a bee-line for the point where "X" marks the spot?

The "crash-wagon" ready to start out. On the running board are the fire-extinguishers while other equipment is carried within the truck. *Photos by U. S. Army Corps.*

The white snow-like deposit is the residue of the "Foamite" extinguishing fluid.

It was at the 1931 National Air Races at Cleveland last August. The Marine team was up, had been through their tight formations and then broken into a Lufbery—a "Royal Bat Race." In and out, dodging and twisting in their follow-the-leader stunts, the leader "Scotty" Sanderson, dived down, then came up into a chandelle, and—

"Ah"—a moan went up from the grandstand, I could hear it up in the press-box near the tower. The sky was littered with yellow and silver fragments of fabric and splinters, and then—"Ah, look!"

Two white blossoms had burst out in the bright sunlit sky. The pilots of the colliding airplanes, Captain Sanderson and Lieutenant Brice, were floating to earth and getting on Major Harmel's caterpillar list. The crowd in the grandstand and bleachers were on their feet, all ready to dive after the news. The photo men tore across the field in a couple of cars.

WERE they,—thirty thousand of them—ready to succor anyone?

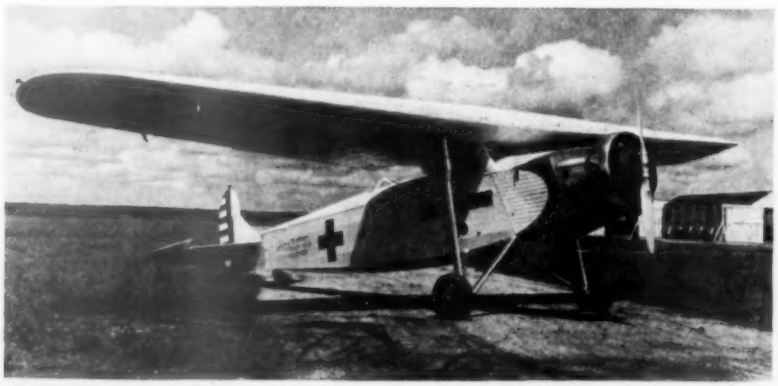
Impossible, for the two pilots were already on their feet and rolling up their parachutes. What the crowd was going to do was to create a first-class casualty list of trampled humans. That, they might easily have done but for the Navy announcer at the microphone—Lieutenant Emile Chourré. If ever anyone was a steadying influence on a crowd, that lad was the influence.

"You are witnessing something that may be very serious," he announced. "But no, it appears that the two pilots are out and will come down safely. As soon as we get the news their names will be announced."

That satisfied the curiosity of the crowd. They subsided into their seats. Calm prevailed. If you were at the Races, you'll remember the incident.

They would be given all the dope as soon as it could be gathered. "Why, sure," said everyone to his or her neighbor, "There's nothing we can do, is there?"

Now suppose a pilot *had* been carried down to crash in his plane, and instead of several thousand reaching the spot, you, Mr. Reader, were the only one or



Uncle Sam's flying hospital, a Fokker monoplane completely equipped with all the instruments and surgical appliances necessary for treating the wounded. *Photo by U. S. Army Air Corps.*

one of several. What would *you* do? Then, again, what *should* you do?

I asked Major C. L. Beavan, one of the two flight surgeons on duty at Army Air Corps headquarters in Washington. Major Beavan has had considerable experience in the handling of patients in airplane ambulances down at Kelly Field and around the country in general. He was the Chief Flight Surgeon of the 1st Air Division last May during the Air Corps Maneuvers.

"Shock," he said, "is the important thing in a crash wherein the airplane occupants are injured. Of course, if fire breaks out there isn't much one can do. Crash-wagons or field ambulances at our army fields invariably carry a grappling hook on a steel cable. By throwing the hook into the longerons of a wreck, and dragging away with the car, there may be a chance to save the occupants from the flames. Extinguishers are not always present in sufficient quantity to put out a gas fire.

"But shock, as I said, is the thing that usually does the damage. Whenever injury occurs, as the result of a fast moving object, even though the external evidence seems slight, it is transmitted by the nervous system to remote portions of the body which are affected thereby and are damaged accordingly. That is what I mean when I speak of shock.

"It is greatly increased by bleeding, fractures and pain. The symptoms are pale face, cold clammy sweat, rapid weak pulse and shallow breathing. In our well-meaning effort to do something for the injured, we usually hurry him to a hospital in a half-lying, half-sitting position in the first available transportation before he has been first properly treated. That adds insult to injury."

"THE layman is justified in removing the victim from the wreckage, or better yet, the wreckage off the victim, if this is possible. Place him on his back, even on the ground when necessary and that only.

"Except when there is danger of freezing, it is better to keep him in this position, even for hours, until a doctor arrives; and the broken bones have been splinted, the pain allayed or the hemorrhage is stopped. This may sound heartless, but we have found that moving a patient before he has been treated for shock, *decreases his chances for recovery by fifty per cent.*"

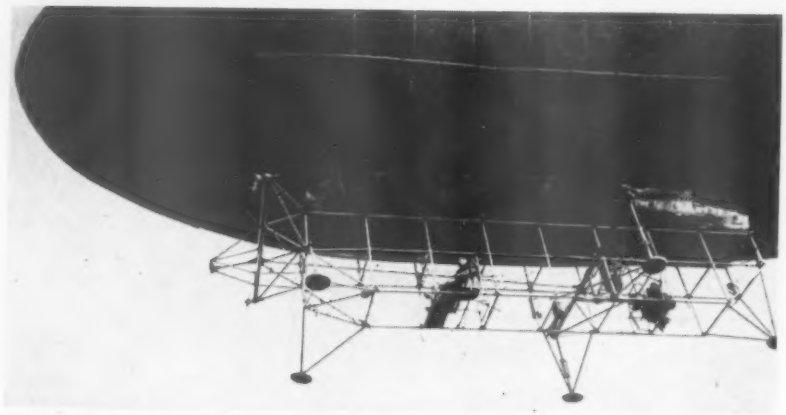
While it was not the original intention of the author to hold forth on first-aid methods, a few do's and don't's may be appropriate. They are from reports of the Army Medical Corps on the subject of treatment for shock and general serious injury.

"After placing the patient on his back," reads the instructions, "loosen the clothing about the neck, chest and abdomen. Keep warm with blankets,

(*Continued on page* 259)

Is the Helicostat a Forerunner of Muscle Powered Flight?

By A. Guillaux



An example of a helicostat or combination dirigible and helicopter. Note the lifting screws on the side of the nacelle.

THE helicostat, or a combination of lighter-, and, heavier-than-air-craft, is an old dream of scientific fiction writer.

We remember many pleasant hours spent, during our school years, reading about the amazing destruction of "enemy" fleets and armies by strange aircraft deriving their lifting power partly from gas cells and partly from windmill-like vertical shaft propellers. Those were the days when 60 miles was "some speed" in the air. Two hours aloft was a duration mark for any flying thing but dirigibles.

Many practical experimenters were formerly at work in the helicopter field but were badly hampered by the tremendous weight per horsepower of the then available motors. It is no wonder some of them thought of using gas cells to contribute most of the required lift and thus leave only a few hundred pounds for the vertical shaft propellers to pull off the ground.

The idea of muscle power flight received a new impetus when power flight came into being. The idea ended in practical failures when it became evident that human muscle alone could not deliver, steadily, the minimum of power necessary for sustained flight. Even bicycle endurance champions, while able to take off, couldn't keep it up. So ended the "aviette" construction fad that came shortly after the war and threatened to take France by storm.

In the early "twenties", another form of muscle-power flight started in England and Germany under the name of "balloon-hopping". The hoppers were suspended by a harness from a diminutive balloon, the lift of which was slightly less than their own weight.

They took off by springing up from a squatting position while some others actually did resort to a vaulting pole. Lacking directional control with the free balloon, the new sport resulted in a lot of involuntary trespassing. It failed to gain enough popularity to win it recognition as a distinct division of aeronautics.

Once again, coming from a Latin country, the Oemichen "helicostat" promises new and interesting developments in the slow flight field. It appears to be as practical as the autogiro when the latter broke into the

(*Continued on page* 258)

Crippled Landing Gears Cause Many Accidents

THE aeronautical branch of the Commerce Department reports that more than three-fourths of all aviation accidents due to structural failures, are caused by breakage of the landing gear.

The bureau recently made a series of tests to check the efficiency of the designs now existing in airplane construction. They hope that their studies will prevent further accidents of a similar nature.

They checked the causes and nature of fifty accidents, all occurring within the past six months. However, six of these involved unlicensed planes and the Commerce Department has no control over them as to airworthiness.

But of the forty-four licensed plane accidents, thirty-four were caused by landing gear failures. The others were divided into the following groups: Wings, 4; control surfaces, 1; floats and hulls, 2. The control system, engine mount and propellers caused one each.

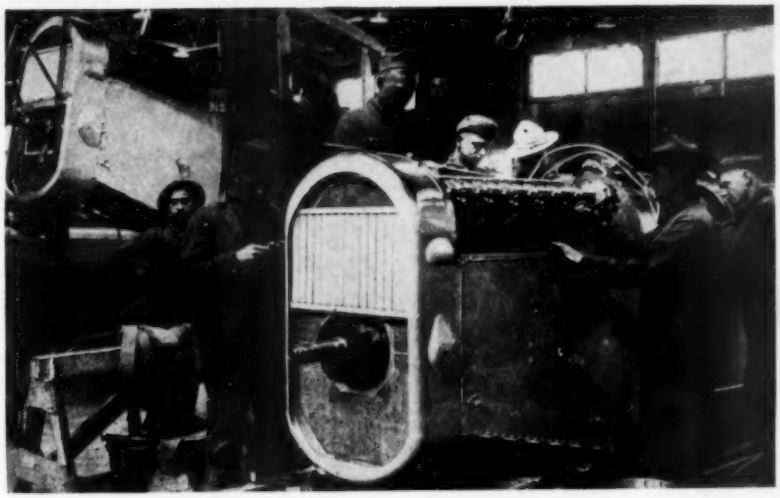
The experts made a careful check on each of the accidents and, as a result, have determined that in the future, all pilots and plane owners should give more consideration to the shock absorbing unit qualities in the landing gear. Particularly to the various types of tires.

They also stressed the importance of determining the exact allowable loads for each member of the landing gear unit.

XUM

Official Exam Questions for Mechanic's License

Next month the answers will be printed. These answers will be correct, and will be submitted to the department inspector in the Chicago territory. It has been suggested that the readers try to answer the questions, writing them on paper and compare with the correct answers that are to be published.



A class in engine adjustment and repairs at a U. S. Army school. The questions cover such subjects as are being applied in this photograph.

DURING the past six or seven months there have been many requests from our readers to publish a list of questions for the various aviation licenses required in this country. We are very glad to have received an official list of sample questions from the United States Department of Commerce, pertaining to mechanic's licenses.

These questions are not the identical ones that are given to an applicant, but are only samples. In other words, they show the type of questions the examiner is likely to ask.

Mechanics may be licensed as engine or airplane mechanics, but a person may hold a plurality of licenses, such as both classes of mechanic's license or a pilot's and a mechanic's license.

The Air Commerce Regulations require previous experience of candidates for either type of license. They must also prove by successfully accomplishing a theoretical and practical examination that they are qualified to perform the work permitted by a license.

Candidates for either type of license, in addition to specific examinations on their knowledge of airplanes or engines, are examined on portions of the Air Commerce Regulations pertaining to a licensed mechanic's work. They are also examined on Aeronautics Bulletin No. 7-H, which is a part of the Air Commerce Regulations, and governs the alteration and repair of licensed aircraft.

Examples of the types of questions asked are given herewith. The questions under the heading Air Commerce Regulations, are representative of those asked candidates for either type of license. The questions under Airplane Engines, are typical of the written examination for prospective airplane engine mechanics, while the set under the heading Airplanes, applies to candidates for airplane mechanic's license.

AIR COMMERCE REGULATIONS

How often must a licensed airplane be inspected? By whom?

What lights must be carried on a plane carrying passengers for hire at night?

What entries are required in the airplane and engine log of a licensed airplane?

May an unlicensed mechanic work on a licensed airplane?

May a licensed mechanic work on an unlicensed airplane?

What experience is necessary to be eligible for an engine mechanic's license?

What experience is necessary to be eligible for an airplane mechanic's license?

What report must be submitted to the Department of Commerce after an accident to a licensed airplane?

If you fail on this examination, how long must you wait before reapplying?

How long does a mechanic's license remain in force?

What is necessary to renew it?

Give five reasons for the suspension or revocation of a mechanic's license.

Where should the log book of a licensed airplane be kept?

What special equipment must be in a plane making a trip over water?

How often is a line inspection required on a licensed airplane?

Must a licensed engine mechanic be experienced in the maintenance of ignition systems?

Name eight items that are included in a daily line inspection.

Are safety belts required on both closed and open cockpit airplanes?

What would be the meaning of a license reading: R3046?

Is a compass ever required on a licensed airplane?

What is the age requirement for mechanic's license?

What engine instruments are required on a licensed airplane?

What safety equipment is required on licensed aircraft carrying passengers for hire?

May a licensed mechanic ride in the co-pilot's seat?

What civil penalty may be imposed for a violation of the terms of an airman's certificate?

What are the markings for licensed aircraft?

What requirements must be met before carrying passengers for hire in an airplane which has been seriously damaged?

When must a mechanic carry his license?

May a citizen of a foreign country hold a mechanic's license?

Must an applicant for mechanic's license be able to read, write, and speak the English language before receiving a license?

Is anyone other than a licensed mechanic authorized to sign the log book of a licensed airplane?

How do you tell the difference between a licensed and an unlicensed airplane?

What are the sizes of the letters and numbers required on the wings of an airplane?

What are the requirements relative to the placarding of baggage compartments in licensed aircraft?

When must a navigation summary report be submitted to the Secretary of Commerce?

How shall a serious accident be reported which results in serious injury to persons?

What procedure is necessary in repairing a licensed aircraft which has been seriously damaged before the license can be continued or be renewed?

If a component is damaged more than 50 per cent, what procedure is necessary?

Does it make a difference if the repairs are made at an approved repair station?

What constitutes a line inspection?

When is a first aid necessary on a licensed airplane?

Is a fire extinguisher on all licensed aircraft a requirement?

When is a gasoline gauge required on a licensed airplane?

Who is responsible for signing the log when repairs are made to a licensed airplane?

What equipment and facilities are required in order for a repair station to be approved to repair welded tube

(*Continued on page* 260)

A Typical Japanese Attack Plane

A Japanese pilot in front cockpit and gunner in the turret with an advanced type of machine gun. It is this type of plane that is now seeing service in China.

THE Japanese have a very modern aviation force. The illustration shows one of their latest attack planes.

The plane is highly developed for efficiency in battle. The cockpit and gunner's turret are armored. The wing is cut away above the pilot to increase his view. The machine gun has a universal mounting, making it possible to fire in any direction.

The "quick vision" sights are a very recent improvement. Note the absence of a drum magazine, as is common on a Lewis machine-gun. A cartridge-box and flexible belt are used instead. More compact than Lewis gun.

A Training Record

Paul Jones standing beside his training plane. He soloed after forty minutes of dual instruction.

WORD has just come to POPULAR AVIATION of a young man, seventeen years old, who flew solo after only forty minutes of dual instruction. Previous to his dual instruction he had never even been in an airplane. This young man's name is Paul Jones. It sounds like a sample of the stock as that of the famous naval officer of the same name.

As soon as he had received his flying license his instructor put him in a large ship, and without any instruction he flew it solo.

Although his performance has a rather reckless or foolhardy sound, his instructor emphatically states that he is very careful and conservative.

Paul Jones was trained at a flying school, located near Chicago. The illustration shows him and the plane in which he first soloed.

Scientific Tests for Pilots

DURING the late war the only test as to a man's fitness to become a pilot was his athletic ability. The question was asked, "What are your athletic activities?" If he played football or boxed, or any similar activity, he was accepted.

That is greatly changed nowadays. True, a man is required to be athletic, but that is a small part of the story.

Among other tests, that of ability to stand rarified atmospheres, as shown in the pictures, is very important. The services of several skilled physicians are necessary. During the course of the various tests as many as fifteen experts are necessary to pass upon the fitness of the candidate. Any man who passes the requirements is in the finest physical condition.

40 Million Letters By Air Mail This Year

AIR MAIL planes will carry 40,000,000 pieces of mail this year, according to an estimate of United Air Lines. Growth of the service is illustrated by these figures:

1926	810,000 lbs.
1927	1,654,000 lbs.
1928	4,063,000 lbs.
1929	7,772,000 lbs.
1030	8,005,000 lbs.
1931 (Estimated)	10,000,000 lbs.

War Photo Fan's Club

THE response to the new club, The War Photo Fan's Club, was fine. Many letters were sent in for membership and to tell us that the readers thought it was a fine idea. One reader has already made a good swap.

We are glad to list any amateur who will send in his name. The name and address will be published in the first issue after the names are received.

POPULAR AVIATION cannot be responsible if any member of the club does not play the game fair and return either the photos, the money or the swaps. We will do our best to publish the names of reliable people, but we cannot always be certain as to their honesty.

Here are the new additions to the list:

Wallace Sharp, Jr., 1523 29th Ave., Oakland, Calif., wants photos of World War airplanes of all types.

Louis H. Grimes, 29 Water St., Hallowell, Me., wants pictures of war-time planes.

Wm. Keleman, 7920 Rawlings Ave., Cleveland, Ohio, wants pictures of training planes.

B. H. Heinowitz, Mountainside, N. J., has all kinds of plane photos. He will sell or trade.

Bill Sander, Box 363, New Brunswick, N. J., wants pictures of planes, about 8 inches by 12 inches.

Arthur Miller, 26 Barnes St., Bristol, Conn., wants pictures of war-time planes in action and fighting.

William Hamilton, 1911 Oglehart Ave., St. Paul, Minn., wants to hear from readers who are interested in photos. He has quite a few pictures of different planes.

Billie Mitchell, Waleetka, Okla., has many pictures of planes, and is interested, not only in getting more, but in getting rid of some he has. He will deal on a strictly swap basis.

Clair Smith, of Gap, Pa., wants to swap all kinds of airplane pictures. He is not particular about photos, but will be glad to consider newspaper and magazine clippings.

Frank Scheffmann, 1747 Cleveland Ave., Chicago, is interested in airplane photos.

Robert C. Rudisill, 414 E. Washington St., Sandusky, Ohio, is glad to hear about the new club. He is interested in obtaining photos "by any means" suitable to seller. Write him to inquire just what kind of pictures he is interested in.

That is the list of new members. Any one else who is interested will have their name published in this column if the letters will just come in.

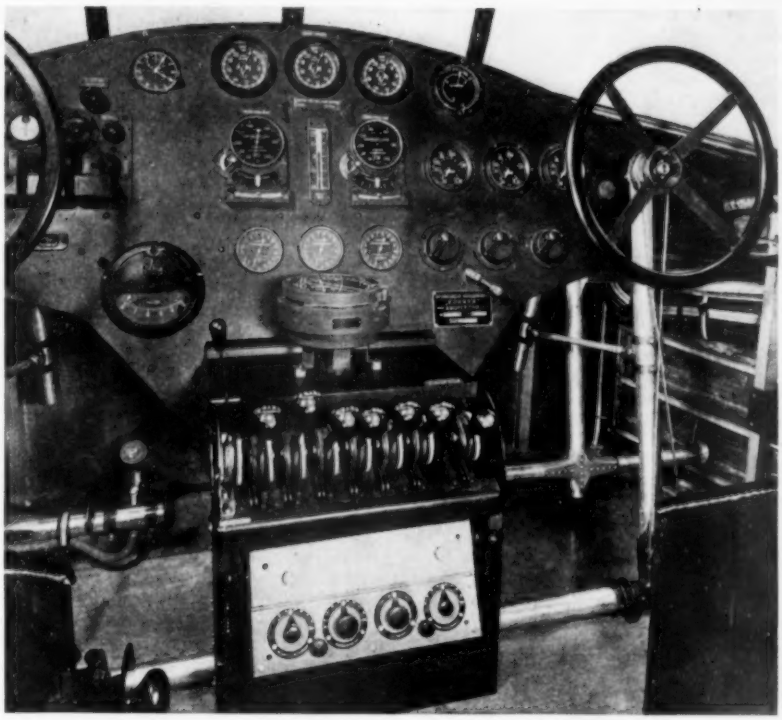
Just as a favor, please be sure your name and address is easily read. Not only is it tough on the eyes of the Editor, but there is a chance that he will not be able to read the address correctly, and the letters will not reach the proper person. J. M. H.

XUM

Listen-In to the Pilots With a Short-Wave Set

by CAPT. CHAS. W. PURCELL

Cap Purcell tunes into the short-waves and gets a thrill out of the pilots broadcasts. By means of a short-wave radio set, or a short-wave converter, you also can get valuable, and sometimes exciting, information from the broadcasts sent out by the air liners.



At the center and bottom of this photograph is shown a typical radio set used on transport ships. These sets both transmit and receive messages.

ANY of you fellows who have an airplane without a "kilocycle-catcher" in it are missing half your life, and if you haven't one in your home—well, it's just too bad. Short-wave outfits are chiseling their way right into the life of aviation and, after a while, will be as much a part of the ship as the motor or tail assembly.

A fast-talking radio salesman cornered the writer the other day, and when the salesman finished, yours truly was the proud owner of a combination short and long-wave outfit. Heretofore, I had very little use for the radio, but the set went home anyway.

Several hours were consumed in hooking it up. (No! you married men. I'm speaking of a radio set, and anyway they don't wear 'em any more.) Well, to go on with the story. Through some misunderstanding, the outfit was hooked up wrong at the beginning and the writer tried for four hours to tune in a dead set. (Aw, shut up! I didn't say I was a radio sharp.)

With the aid of a couple of alleged radio men, I got right again and started at the beginning. Phooey, what a job this short-wave tuning is. I was told to turn the knob very slowly. Well, I did. I turned at the rate of one-tenth of one per cent of an inch per hour, and finally picked up some music. Hah! This must be Russia, I thought.

Song after song came from the set, and that doughnut gedunker refused to announce the name of his station. It didn't sound quite like Russia, but I thought it could be England, or maybe Mars. After thirty minutes, the announcer finally gave in and announced his station—the big stiff. Distance—my eye. The sending station was just a few blocks from the writer's home. Bahhhhhhhhhhhhh!

I felt like kicking that speaker right in the face, but when I thought of the hundred bucks that had been invested in the set, I changed the old mind.

This set was purchased to listen to some of these night flyers—ships that pass in the night—and to pick up some weather reports, along with anything else that the little kilocycles had to offer. At the rate I was progressing, it would have taken some three thousand years to catch a kilocycle, or meter, or whatever you call it. I went into a huddle and decided to call the field radio man for some assistance.

This radio man was asked how to tie this set to one of their kilocycles. He gave the main guy's name and it was "Meters".

My set is marked off in megacycles, so it meant another call to the field to find out what relation a megacycle is to a kilocycle—if any. On the last call I learned that a megacycle is one million cycles and I could divide 300,000 by the kilocycles and the answer would be meters.

It looked to me that the answer should be the distance to the moon. This whole thing was as plain to the writer as Einstein's theory. Right here, I want to apologize for anything I ever said about radio men. Anyone who can take these mental hurdles and still talk the English language, has something on the ball.

WELL, I started back on the dial again and tuned and tuned and tuned, but the answer was still large slices of silence. Again I was about to kick that set in the face, and again the only thing that held me was the dollar sign. This dollar sign almost failed at the end of the next half-hour. Nothing in the way of language came from that set, but a lot went into it.

Just to be able to throw that set out of the window was the ambition of my life right then. At this stage of the game, the writer's hair was standing on end, his tie was on backwards, the floor was covered with cig butts and he was just one stage removed from a coo-coo. I made a mad lunge at the volume control, gave it full gun and—.

"Virden in Olympia—calling Oakland," said my radio.

Boy! I went straight up into the air in one of the most perfect flat spins a human body was ever put through. This no-good set was working at last. I climbed right on the floor and tried to put my head into the speaker. I listened with both ears. The thought suddenly struck me that I had been working with about five per cent of the throttle capacity.

"Oakland, calling Pee-Wee — go ahead, Ralph," said the world's greatest radio set. Now these might just be words to the reader, but they were yellow-backed bills to the writer.

"Over Mt. Shasta—ten thousand feet —visibility good. Will land on schedule —go ahead, Oakland," said Virden, with the aid of my radio.

"O. K.," said Oakland.

For one hour I sat there on the floor

and listened to ships of the air as they winged their way from the north and south borders of our fair land and from Oakland to Chicago. Talking from a plane to the ground has no thrill at all, but listening to a plane in the air—ah, that's different.

I heard Allen Smith ask where he was as he approached Oakland in the fog. I heard the radio man tell him he was over the Berkeley Hills. I heard Smith say he was going to land at the Bay Aerodrome and heard him ask for wind direction at that point. The Oakland man said he didn't know the wind direction at the aerodrome, but he could give him the dope on the wind at Oakland Air Port.

I heard Johnnie Guglielmetti ask for weather at Reno and we heard Reno answer almost before he had finished. I heard old man Remelin paged three times by some goofy station in the south, and when the boy answered, he explained that he heard the calls but was busy piling through a snowstorm over the Ridge and could not answer.

The palooka on the ground then told him it was all right, he just wanted to know what time he left San Diego. Now can you imagine interrupting a man's flying time to ask him a silly question, especially when that man is doing the flying of his young life?

I FINALLY dragged myself away from that set as I felt the want of something to eat. I turned off the set. I did this gently so that no little kilocycle would become insulted and refuse to play around my speaker. I rushed from home and into the restaurant.

The way that the waitress jumped, when I gave my order, led me to believe that I was still talking "kilocycle talk". I wrapped myself around that grub so fast, the pie pushed the soup out of the way, and got down first. I finished the last two mouthfuls out on the curbstone.

I rushed back to the set, and started the hootenannies back in motion. These things have to get hot for some unknown reason and, to a man in a hurry to catch a kilocycle, it seems to be an unnecessary wait. The heating process had been in effect for some five or six minutes, but the set was deadly quiet, except for some of this static stuff. Oh, how I hate that guy that invented this stuff—static. It was going to be necessary for me to tune again, and I felt like the end of the world had arrived.

". . . and I'm just a prisoner of love," said my radio. Somebody must have slipped over a kilocycle and fell into the meters. What was this guy doing on a short-wave. He had bigger waves to play on, but, of course, he had to pick on the small ones. "Prisoner of love"—hooey!

MY perseverance came to the fore and I desisted from kicking the speaker in the face. I tuned some more instead and how I did tune! Seven-tenths of one-hundredth of an

(*Continued on page* 265)

The Akron "Parks" on a Naval Vessel

The dirigible is approaching the shipboard mooring mast, ready for a "tie-up".

THE great dirigible of the U. S. Navy, the "Akron", has proven that it can be moored to a warship.

On January 17th, 1932, she hooked her nose to the special mooring mast that had been erected on the U.S.S. Patoka. After remaining there about forty-five minutes, she uncoupled and sailed back to Lakehurst, N. J.

The practicability of using a ship for mooring a large dirigible has often been questioned. That discussion is now settled. Indications are that even a moderately rough sea will not interfere with the operation.

The picture was taken from the bridge of the U.S.S. Patoka, just as the Akron was starting the second attempt.

New Container for Life Rafts

THE army is now using this streamlined container for the rubber liferafts used by land planes when flying over water. When the shell is opened, the raft can be removed and inflated without loss of time. In a pinch, the container could be used as a small boat, if the water is not rough.

A convenient rubber container for the rubber life-rafts used by the Army.

Well, Perhaps and Perhaps Not

THE parachute is often looked upon as an instrument of torture—such as a Saturday night bath during zero weather.

The word "Parachute" is made up of two Scandinavian words, the root "para" meaning two (such as para shoes or para pants), and the word "chute" meaning to kill or murder. When we sum the two words up, we find it means two chances to one the thing won't open, or else two chances to one it will, depending upon the horoscope of the wearer.

The makers of the parachute tell us that it cannot fail to open, and even if it doesn't open, the victim soon gets used to it. This can be explained by showing that a man can be hung, and after he gets used to it, he doesn't even mind hanging.

In other words, even hanging is easy after you get used to it. They also have an unconditional guarantee that if you use the chute, and it doesn't open, that they will gladly replace it free of charge—if you bring it back. To date there have been no complaints. That is a pretty good record considering all the chutes that did not open.

There are many conditions under which parachute jumps are made. Some jump because of a broken heart over a love affair. Some jump because they need twenty-five dollars, and other because they were in the last row when the brains were passed out.

Personally, I wouldn't jump unless I was in a burning ship with the wings torn off, in a tailspin and with two fellows pushing me out. Some people say they just know they'd forget to pull the ripcord. That's foolish. It's just like a deep-sea diver going down into a hundred feet of water and forgetting to put on his diving outfit.

These fellows who have jumped from an airplane with a parachute have formed a club. It is called The Caterpillar Club. The first man to jump organized this outfit. It all happened like this:

A fellow was flying along with his wife. She started to tell him how to fly and how not to fly, and he jumped out. That was where the worm turned, but instead of calling it The Worm Turned Club, he shortened the name to The Caterpillar Club. Since then, every man who has made an emergency jump has been admitted to this outfit.

There are wonderful possibilities for the parachute when it becomes fully developed. When a person is on the top floor of an office building, and gets tired of waiting for the elevator, he can strap on a parachute and jump out of the window, thereby saving himself a lot of time. And before long, a girl instead of walking home will be parachuting home.

Instead of an umbrella, we'll all be carrying parachutes, when we commute in from the suburbs on the 8:15 A. M. suburban special. If the weather is fair, we might even land on the office roof—who knows?

XUM

Future Planes Will Fly at 1,200 Miles an Hour

PLANES of the future that travel at altitudes of 65,000 feet and at a speed of 1,200 miles an hour is the prediction of Professor Alexander Kemlin of the Guggenheim School of Aeronautics.

That the present maximum speed of 408.8 miles an hour will eventually be increased to three or four times this figure was explained by Prof. Kemlin in a series of demonstrations.

Mathematical equations show that the Ford tri-motored ship with a maximum speed of 156 miles an hour at sea level, would be able to travel at a speed of 294 miles an hour, while flying at an altitude of 60,000 feet, providing the engine power would remain constant at such extreme heights.

To maintain the power of airplane engines in a rarified atmosphere it would be necessary to equip them with superchargers. Recent tests conducted by European scientists prove that the modern plane equipped with the necessary devices could easily double its speed by flying at a higher altitude.

Professor Kemlin stated that among the modern planes which have shown the most gratifying results in stratosphere flight tests are the Farman planes of France and the famous German Junkers. But the stratosphere craft of the future will be quite different from the present high speed racing plane, according to Professor Kemlin.

The wing surface will be a great deal larger and there will be lighter loading. This plane may be inefficient at sea level altitudes, but once a great height has been reached it will be unsurpassed for speed and endurance.

U. S. Marine Aviation Corps Aids Sufferers

THE Marines and the Lexington aviation units conducted extensive relief operations after the Nicaraguan earthquake. The Lexington was sent at full power from the vicinity of Guantanamo to the coast of Nicaragua and there launched planes with doctors, medical supplies, and food, and kept sending such supplies until the emergency had been cared for.

The airplanes attached to the Marine Corps forces in Nicaragua consist of 15 observation and scouting planes and 5 transport planes. Two of the transports were flown to Nicaragua to augment the forces there in order to transport personnel and supplies after the recent earthquake in that country.

Two transports were flown to Santo Domingo with vital medical supplies immediately after the hurricane there which occurred in September, 1930. These planes did most valuable work in transporting supplies and personnel between Port au Prince and Santo Domingo.

Dornier Produces a New Goliath of the Air

At the right is the giant Dornier DO-K, a rather unusual design for a Dornier.

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Below is a close-up of one of the double engine mountings, one engine in front and one at the rear.

THIS mighty monoplane, the "DO-K", is a companion to the "DO-X". It is the latest product of the Dornier Works, of Germany.

The trial flights of this plane have just been completed at the Tempelhof Field, Berlin. It has been especially designed with the idea of securing safety in aerial transportation.

The unique mounting of the engine has aroused the interest of airplane designers. The fairing of the struts, the landing wheels, and the engine housing are especially interesting.

The plane is to be used in the commercial air-lanes in Europe, carrying passengers and mail. According to present plans it is to be put in service some time this spring.

A close examination of the engine mounting will disclose a streamline ring on the forward engine that is much like those used in the U. S. A.—a new departure for Germany.

The rear engine, however, has no streamline ring, and strange to say, the trailing tip of the streamline case ends directly in front of the rear engine.

It is also interesting to note the long projecting nose of the fuselage. This projects beyond the wings by a distance equal to about one-fourth the total length of the body.

The Fairey "Fox," British Day Bomber

THIS plane was introduced by the Fairey Aviation Company to satisfy the need for a light weight, high performance day bomber. It has been designed to be capable of resisting the attack of a single seater, pursuit plane.

In tests and sham battles, the "Fox" has repeatedly broken through the defense of single-seater fighters.

The "Fox" has its two wings staggered. The fuselage is narrow and highly streamlined. There are two cockpits and two machine guns.

The dimensions of the "Fox" are:

Span—38 ft.

Length—28 ft. 3 in.

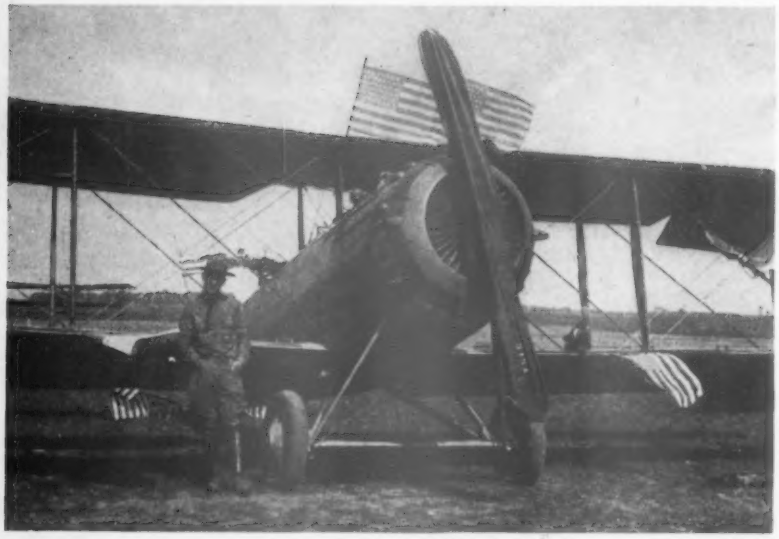
Height—11 ft.

Total useful load—1750-1900 lbs.

The Fairey "Fox" a well known British day bomber.

A Complete Summary

by
LIEUT.
JAMES M. RICHARDSON,
noted authority
on
wartime equipment.



The Salmson 2-A-2. Picture taken at Orly, France, on July 4, 1918. Lieut. Dogan Arthur of the 12th Squadron standing in front of plane.

DURING the World War, 45 American squadrons were assigned to the front. Of this number only 34 actually engaged in intensive warfare. The Armistice was signed before the remaining 11 got their full equipment and perfected their team-work.

The 34 squadrons that flew over an active front were classified as follows: 15 pursuit, 13 observation, four day bombing, one night observation and one night pursuit. The 155th Squadron, the only night bombing unit assigned to the war zone, failed to make a single raid.

The American squadrons flew only ten different types of planes, all of them biplane tractors, into battle. These were the Spad 11, Avion Renault 2, Sopwith 1½ Strutter, Salmson 2-A-2, Nieuport 28, Spad 13, Sopwith Camel, Breguet 14-A-2, Breguet 14-B-2 and De Haviland 4.

However, American airmen, attached for experience to the Royal Air Force, the French Flying Corps and the Italian Air Service, flew many other types such as the S.E.5, the Bristol Fighter, the Handley-Page and the Caproni. It is not the purpose of the present article to enumerate every battle plane flown by an American but merely to tell something about all those used by purely American squadrons.

The 1st Squadron holds the triple distinction of being the first American outfit assigned to the front, the first to send a plane over the lines and the first to engage the enemy in combat. It might also be pointed out here that the 103rd Squadron, composed principally of veteran airmen who had flown with the Lafayette Escadrille and the Lafayette Flying Corps, began work with the French Flying Corps on February 18, 1918.

This date, however, merely marks their recognition as an American unit attached to the French, for nearly all the personnel had already flown for months over an active front.

On April 10, 1918, four days before the 94th Squadron went into action, two officers of the 1st Squadron flew over the lines. Two days later Lieutenant Arthur Coyle, and observer of the same outfit, had an aerial battle with three German planes but escaped with a few bullet holes in the wings. The squadron was then operating over the Toul sector and flying the Spad 11.

The Spad 11, a French plane, was a two-seater resembling in general design the famous single-seaters, Spad 7 and Spad 13. To improve the view, the rear of the upper wing was cut out above the pilot's head and the lower wings were cut away next to the fuselage.

The landing wires were single; the lift wires doubled with strips of wood, streamlined and fitted in between. The interplane struts were of wood and, unlike those of the single seaters, converged towards the top wings.

TYPICAL of all Spads, the radiator was in the nose and provided with shutters. The undercarriage struts were "Vee" form and fabricated with layers of wood glued together. Exhaust pipes extended beyond the pilot's seat on both sides of the fuselage.

A reservoir for the radiator and a small gasoline gravity tank were both built into the upper wing. The main gasoline tank, which was under the pilot's seat, fed the fuel by pressure and held sufficient supply for two hour's flight.

The ship was powered with a "Vee" type Hispano-Suiza and had a two-bladed propeller geared down in the ratio of 4:3. It mounted one fixed Vickers gun for the pilot and twin Lewis guns, fastened together, for the observer.

The Type 11 had the usual Spad hand magneto for starting the motor and a hand operated air-pump.

So much for constructional details of a machine that was utterly worthless for observation. History will

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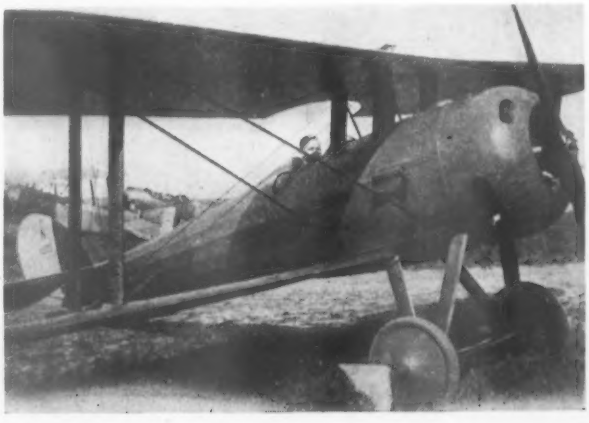

Nieuport 28, showing characteristic cowl. It is this plane, maneuverable but dangerous, that appears most frequently in fiction.

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# of World War Planes

Planes used during the World War have a strange fascination for most of us. In this article we have described all the ships flown by American war pilots, including several rare photographs.

Avion Renault equipped with the Renault water-cooled engine.

probably record the Spad 11 as the most unsatisfactory war plane ever built. The chief trouble lay in the motor which was developed especially for the Type 11 but unperfected.

A flight in a Spad two-seater without motor trouble was a rarity. If the reduction-gear for the propeller didn't start grinding, then the pilot could be sure of an oil leak resulting in an overheated motor. Both of these troubles caused a loss of power which made the Spad 11, usually weighted down with machine guns and apparatus, very dangerous.

It's difficult to believe that the Spad 11 was a creation of the same minds that produced the Spad 7 and the Spad 13, among the finest pursuit ships of the war.

The Spad 11 was condemned by the French. The Americans tried it, because there was no really first-class two-seater like the Breguet or Salmson available in early 1918. The Spad 11 seemed to be more desirable than the Avion Renault or the Sopwith 1½ Strutter—both of them slow machines.

Needless to say, we equipped the observation units with the Salmson as soon as possible, but in the meantime the 12th Squadron went into action flying Avion Renaults and the other observation units used Sopwith 1½ Strutters.

THE Avion Renault, commonly called the A. R., was a French plane also. It was rather unusual in appearance due to a high, narrow fuselage that was supported on ash struts between the wings and sat at least eighteen inches above the lower plane. The top plane was staggered backwards, while the lower plane had a pronounced dihedral angle and sweep-back.

This machine was the most curious mixture of the then modern features that had been discarded by most manufacturers. It had wheel control instead of the stick, for instance. No vertical fin, non-balanced ailerons, a balanced rudder and balanced elevator pivoted to a very small tail plane.

Then the floor of the fuselage, in front of the rudder-bar, contained two small windows through which the pilot could look below. Both the Salmson and the later type Breguets were fitted with such windows, which were considered advanced features in 1918 and peculiarly French.

The motor was an 8 cylinder Vee type Renault that delivered 190 h.p. at 1550 to 1600 r.p.m. The radiator was suspended between the body and the lower wing.

The pilot had one fixed machine gun on the right-hand side above the body. Bowden control was used to fire the gun from the control wheel.

The observer's cockpit was fitted with two movable machine guns, racks for eight bombs, a shelf for camera plates, wireless apparatus and two folding seats—one in the rear and one in the front.

The pilot had a good view forward but the view upward and to the rear was cut off by the upper wing.

One of the strangest features of the A. R. was the manner of bracing the outer plane struts. In addition to the usual wires, the middle of these struts were braced to one another and then to the body struts.

Spad 11. Picture taken at Etampes, France, June, 1918. A popular plane in fiction.

+ + +

THE A. R., of course, was out of date in 1918. It was weak, maneuvered like a steam roller and had a decided tendency to nose down to the left. By test, the machine was rated 24 miles an hour slower than the then modern Salmson and 18 miles an hour slower than the then modern Breguet.

But we could procure neither of the two latter types, so the members of the 12th Squadron went to war very, very slowly, so to speak, on the A. R. The Spad 11 was faster than the A. R.;

nevertheless the A. R. was a jewel of perfection compared to the Spad. At least the Renault motor was dependable.

With no suitable battle-planes being produced in America, our air service had to start with any makeshift equipment it could buy from the English and French, who up until June, 1918, were unable to supply us with any of the latest type observation planes. Thus, other early observation units went into action flying another out-of-date plane, the Sopwith 1½ Strutter, an English machine of unusual historical distinction.

The Sopwith 1½ Strutter, accepted by the English in December, 1915, made its debut on the front on May 24, 1916, when the 70th Squadron, British, was equipped with it. The 1½ Strutter was the first English airplane to have a synchronized gun firing through the propeller.

Machines of this type also carried the first Scarff No. 2 Ring-Mounting into action. The Scarff gun-mounting, for the observer's Lewis guns, was the most famous gun-mounting of the war and remained standard until the Armistice.

The Sopwith 1½ Strutter set a world's altitude record of 23,980 feet, but its chief fame came from its excellent performance over a long period as a two-seater fighter and observation plane. When the machine first reached the front, it was considered a very fine ship. It had speed, good maneuverability, fine armament and sufficient strength for the period.

From the very beginning, this plane was a tremendous success and helped materially in breaking down the great original Fokker threat in 1916. Through in 1916, and part of 1917, the Sopwith 1½ Strutter was a popular and effective plane and could combat anything the Germans had on fairly even terms. Roumania, Russia, Belgium and France all used the 1½ Strutter, France building over four thousand for herself.

THE 1½ Strutter got its name from the wing bracing which was novel, and in slightly altered form, set the pattern for later construction. There was but one set of interplane struts on each side. Running out from the top longeron of the fuselage, to the front and rear wing spars, there were support braces like short struts. The "½ strut" idea sprang from this feature. Considered together, the central section struts and braces had a "W" formation.

There were two interesting innovations incorporated in the 1½ Strutter when it first appeared—an air-brake and a trimming gear. The trailing edge of the lower wing, near the fuselage, had adjustable flaps that could be altered by the pilot to reduce the speed when about to land.

The trimming gear was to alter the angle of incidence of the tail plane while in flight. The pilot could thus

Tuning up a Spad for service over the front lines.

set the tail at the proper angle for climbing, for attaining high speed or for landing. Or he could adjust the balance for the load he was carrying. Many passenger ships now use the trimming gear.

The Sopwith was finally equipped with a Clerget motor developing about 130 h.p.

Of the three kinds of observation planes, first used over an active front by American squadrons, the Sopwith 1½ Strutter was probably the most satisfactory. But excellent as the machine had been in its day, it was antiquated by 1918, being too weak and too slow to cope with the late German ships in aerial maneuvers that grew more strenuous all the time.

In June, the French began to deliver Salmsons to the Americans. Within a few weeks our six observation squadrons, then engaged on the front, were equipped with this excellent plane. Constructed with tubular fuselage, the Salmson was a ship of pleasing proportions and lines.

It was a two-strutter, most effectively streamlined to overcome the drawback of a large frontal area. The motor, a nine cylinder radial water-cooled Salmson, rated at 235 h.p., formed the nose. Exhaust tubes, of drop-shaped section, projected from both sides of the well-shaped cowl and there were shutters inside the cowl.

A line-up of Breguet bombers. Note the characteristic hoods and stacks.

Thanks to the short motor, the front seat was placed well forward, thus affording the pilot a splendid view in front and above—considerably better, in fact, than that of most biplane ships.

The armament consisted of twin Lewis machine guns for the observer and a single fixed Vickers for the pilot. The gasoline tank was rubber-coated. The pilot's cockpit had a window in the floor that operated on the shutter principle.

Because of its unusual capacity for gliding, the Salmson was a difficult machine for the inexperienced pilot to land. When levelled off, the ship would glide an amazing distance before it reached stalling speed. Adept pilots nearly always brought them in on side-slip or fish-tail landings.

The landing gear was weak and a source of annoyance. The axles frequently gave way when subjected to light strains, and occasionally the metal braces (three on each side) folded up.

ASIDE from the landing gear, the Salmson was a tower of strength. One could dive it ten thousand feet with full motor and be perfectly sure the wings wouldn't crumple. It climbed rapidly under twelve thousand feet but rather slower from that point up to the ceiling.

With the exception of the Bristol Fighter, the Salmson was the fastest two-seater on the front, making 116 m.p.h. with the back seat empty. The motor was dependable, the maneuverability splendid and in performance the Salmson was the outstanding observation machine of 1918.

The six American squadrons that did most of our observation work all flew Salmsons. Moreover, they swore by the machine, and their accomplishments in it were of the highest order. But for the Salmson, our observation work would have been far less effective.

In actual combat, the Salmson was a tough adversary. Not infrequently, nervy pilots turned them on enemy pursuit planes and gave a very good account of themselves. For this reason, German planes were circumspect about attacking the Salmson. The ship rarely burned in the air and could carry about as much enemy lead as any plane on the Western Front. Everything considered, the Salmson was the most satisfactory machine of any type flown into action by the American Air Service.

Even in building war planes, the French did not forget their ideas of beauty. Their finest creation in this respect was the Type 28 Nieuport. Unfortunately, however, the machine had several serious defects which impaired its usefulness. It sometimes caught on fire in the air, and the fabric would

(*Continued on page* 267)

Spindle Rotors Take the Place of Wings

by LAWRENCE E. ANDREWS

Using spindle shaped slotted rotors, the inventor expects to eliminate many of the difficulties formerly experienced with cylindrical rotors

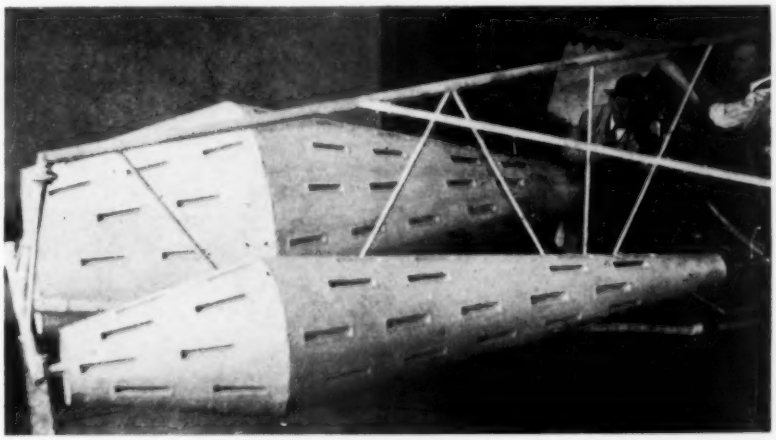
ROTATING conical spindles instead of wings will provide the lifting surface for a new flight machine to be launched at Roosevelt Field this spring. While it is not the first machine projected with lifting rotors, it is the first using slotted, conical surfaces.

It is the invention of John G. Guest, while actual construction is being carried out by L. C. Popper, construction and designing engineer of New York city. A rotor-wing airplane was made a few years ago and was tried out on Long Island but its cylindrical type of rotor set up such an air disturbance that its control was seriously hampered.

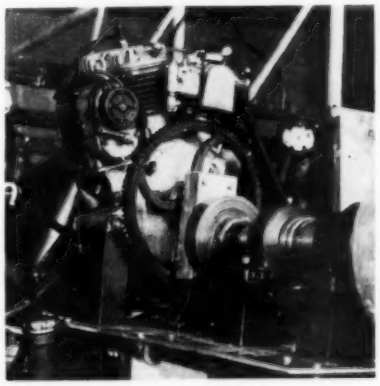
This new ship makes use of the same general principle, but its mechanical execution is decidedly different. Laboratory tests have shown that it has a lifting power of 900 per cent greater than an equally surfaced conventional plane. In addition, it has the ability to land or take-off in very short distances —greatly like the Autogiro.

There are four spindles, two on each side, in place of wings. The lift is created by the rotation of the spindles acting in the slip stream of the forward propeller, the rotation distorting and deflecting the air-stream downwards. Slots are hollowed out in the spindles which offer no resistance to the wind but are caught by the wind as they turn under. The slots serve to reduce the drag which disrupted control with former ships of this type.

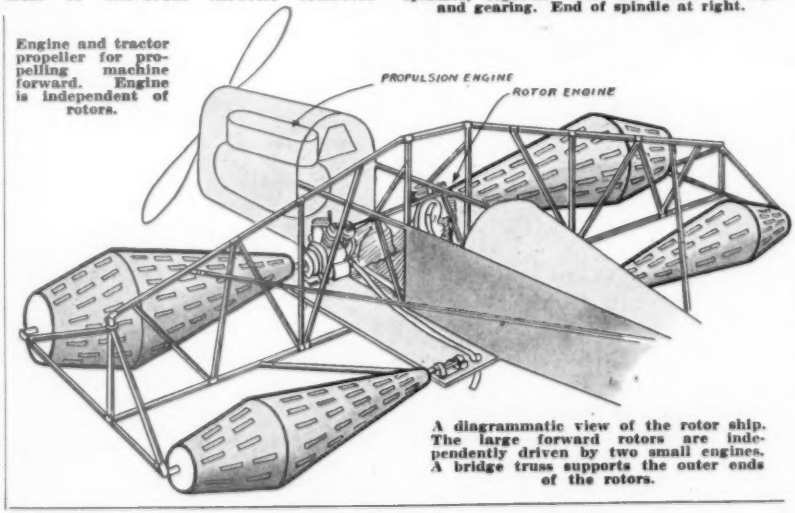
There are three motors in the machine. One, a 90 horse power Cirrus engine provides power to the tractor propeller. Two others, with two cylinders each, provide power to the spindles. A universal throttle connects with the pilot's seat. By speeding up or slowing down the rotor motors, lateral control is accomplished. Elevator and rudder controls govern longitudinal direction in the usual manner.



A close view of the curious rotors showing their shape and the slots cut into their surfaces. Note that the forward rotors are larger than those in the rear.



A detailed view of one of the small 2-cylinder engines employed for driving the forward spindles, together with the main bearings and gearing. End of spindle at right.



Engine and tractor propeller for propelling machine forward. Engine is independent of rotors.

A diagrammatic view of the rotor ship. The large forward rotors are independently driven by two small engines. A bridge truss supports the outer ends of the rotors.

With full weight of pilot and fuel, the machine weighs 1,734 pounds. The cruising range is about 340 miles. It measures 23½ feet from tip to tip of spindles and is 18 feet long. The size compares favorably with that of the small training ship.

The spindles and their assembly weigh more than the wings in the ordinary airplane, but the gross weight is well under the figures set for light airplanes powered with the 90 horsepower Cirrus motors.

A New York manufacturing concern is financing the arrangements for the research and development work on the plane. They plan to manufacture the odd looking craft after the preliminary field and flight tests are made.

This machine is an excellent example of many similar attempts now being made toward producing a direct lift wingless ship. There is undoubtedly a great field for wingless ships of this same general type and inventors will make no mistake in experimenting along these lines.

From experiments made to date, it is evident that the weight of a machine can be supported with a smaller expenditure of power than where wings are employed. Very little power is taken by the rotors, and this fact alone justifies the additional complication.

Whether it will pay to employ auxiliary wings for safety in case of engine failure, it is difficult to say, but in such a case the use of a parachute is an alternative.

The Douglas Amphibian Monoplane Shows Unusual Lines

A Douglas Amphibian standing in front of the Dornier DO-X for comparison.

THE "Lesgo", a snappy Douglas amphibian, is a large monoplane with a cabin holding 8 passengers. It has a 63-foot wingspread.

In spite of its size, it is dwarfed when alongside of the gigantic Dornier "DO-X" shown in the background. The boat shaped hull is clean.

The "Lesgo" is owned by Powell Crosley, Jr. It is the only Douglas amphibian of this type owned by a private individual.

The picture was taken recently when the amphibian came to rest under the wings of the "DO-X" at New York City.

Winter Flying Campaign

IN THE days of open cockpit planes and before the days of improved airports with modern depots, winter flying was an experience. Now this is all changed and air lines are seeking to educate the public to year around trips by air. United Air Lines, which has flown 15,000,000 miles in winter and which last winter completed 95 per cent of its scheduled flying, has demonstrated that with present day facilities, passengers can travel in comfort at temperatures as low as 30 degrees below zero.

Plane for African Hunting

FOR a while, hunters in Africa found the automobile more efficient than the horse in running down big game, but in the last two years modern nimrods have taken to the airplane so extensively, especially in lion hunting, that Great Britain found it necessary to pass a law forbidding the use of the airplane in hunting big game in all its African possessions. It was contended that the plane gives the hunter an undue advantage, so the law was decreed to protect the big game from possible extinction.

Large Scale Model Shows Seating Arrangement

THE illustration shows the scale model of the new British ship, the "Hannibal", the flying giant of the skies.

Every item of comfort for the passengers has been considered. The chairs are luxurious and even tables for card-playing are provided. A bed is included for the care of any passenger who might possibly be taken ill.

This photograph shows the elaborate detail with which the model was constructed—each part being shown, down to the smallest screw.

A Roster of Flight Record Holders in 1931

FOURTEEN American fliers, who established new air marks last year, have received the certificates awarded annually by the National Aeronautical Association. The certificates were presented by Senator Hiram Bingham president of the association, at a dinner given by the Washington Aero Club.

The number of flyers who established new world marks was much larger than in any former year. The list included the late Lowell Bayles, whose certificate was awarded posthumously. The following aviation record makers gathered in Washington for the presentation ceremonies.

Ruth Nichols, who heads the list with three records: altitude of 28,743 feet, speed of 210.636 miles an hour and distance of 1,977 miles.

Amelia Earhart, autogiro altitude record of 18,415 feet and speed record (over 100 kilometers) of 174.897 miles an hour.

Bobby Trout and Edna May Cooper, endurance record of 123 hours.

Wiley Post and Harold Gatty, round-the-world flight in 8 days, 15 hours and 50 minutes.

Major Jimmie Doolittle, transcontinental flight of 11 hours, 16 minutes and 10 seconds.

H. L. Child of East St. Louis, lightplane altitude of 10,898 feet.

May Haizlip, international altitude lightplane record, 18,097 feet.

Frank Kurtz of Los Angeles, junior speed record, 124.86 miles an hour.

James Stickler of Brooklyn, glider record of 7 hours and 28 minutes.

Russel Boardman and John Polando, New York to Turkey, distance flight of 5,011 miles.

Walter Lees and Fred Grossy of Detroit, endurance record of 84 hours and 32 minutes.

Lowell Bayles, speed record for land planes of 281.75 miles an hour.

Kenneth Scholter of Hudson, Ohio, lightplane altitude of 17,457 feet.

Edna Rudolph of East St. Louis, light plane altitude 13,924 feet.

They Prefer Air to Earth

SOARING over twenty-two countries, and landing in forty-nine cities since last June, Mr. and Mrs. Charles Healy Day recently stopped in Los Angeles. They are making a trip around the world in their biplane, starting from London last June.

They claim that death hovers closer to those on earth than in the air. Their most exciting adventure was a forced landing in an Indian jungle which was made on account of a leaky radiator. No mechanics nearer than 500 miles.

Mr. Day, with the help of twenty savages, took out the motor and carted it ten miles to a small village. There, with an ordinary tool set he managed to completely overhaul it, repair the radiator and scrape the cylinder.

Releasing Device for Giant 'Chute

MAJOR E. L. HOFFMAN, in charge of the Parachute Branch, Wright Field, reports the development of a quick releasing device. When he is running drop tests on the 80-foot triangular parachute with a weight, the weight, upon striking the ground, automatically releases the parachute which collapses immediately without dragging.

Since the fabric of the 80-foot 'chute is liable to injury while being dragged, and since any mere man or group of men who tried to stop it by catching at the shroud lines were liable to injury also, some such device was considered highly necessary.

The device is a simple pole arrangement which extends through the bottom of the weight, and upon striking the ground, is pushed up through the weight, releasing a pin which holds the parachute. In a former test, Major Hoffman and his automobile had to be untangled from the shroud lines of the giant 'chute as from a web.

In the last test, the parachute, greatly strengthened in design, withstood a drop with a 1400-pound weight suspended for the first time without the slightest evidence of failure. Further tests are planned in which a delayed opening with the 1400-pound weight will be made. This will produce the greatest shock ever attempted on any parachute known.

The Landing Deck of an Airplane Carrier

THE plane in the photograph is about to land on the deck of its mother-ship. The wide expanse of landing deck is partially hidden by the control-platform seen at the extreme left.

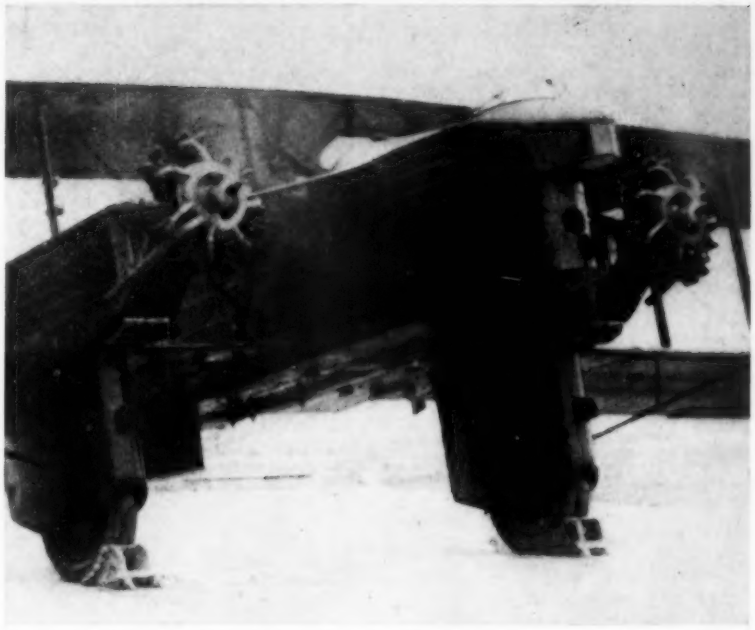
Some idea of the size of one of these landing decks may be obtained from the figures of the men on the extreme right.

The destroyer in the background could easily be put on the top of the airplane carrier.

Recently the navy has placed landing-lights around the edges of the decks to facilitate night flying. Ability to fly at night is now a requirement, and much time is spent to keep the flyers in practice.

A plane about to land on the deck of the carrier.

A Late Development in French Bombers



Here we have a front view of the new French biplane bombers. Note the long overhanging nose of this plane and the wide tread.

THIS is the latest development in bombing planes for the French Air Corps. Unlike the latest U. S. A. bombers, it is of the biplane type. It carries nine machine guns and a cargo of 2200 pounds of bombs. Its speed and general performance have not yet been made known to the public.

Aside from the biplane construction, the most unique feature is the enclosed streamline landing gear. This not only reduces the resistance of the ship but also is an adequate protection against shot and shell.

By the use of twin engines, the nose of the fuselage extends well ahead of the wings so that the ship has both an excellent visual range and an extensive firing zone. With its unusual machine gun armanent it would undoubtedly resist a considerable fleet of fighters.

Plane and Pilot Statistics, 1931

SOME interesting figures on the number of airplanes and pilots have just been released by the Department of Commerce, correct to Jan. 1, 1932.

There were 17,739 pilots of which 6,881 were transport, 1,586 limited commercial, 46 industrial, and 9,226 private licenses.

10,780 airplanes were registered, including 3,227 unlicensed, having identification numbers only.

The licensed pilots included 532 women of which 433 were private and 42 were transport licenses.

New York has the greatest number of aircraft of all kinds, 1,227, with California second. On the other hand, California has the greatest number of licensed pilots leading with 3,327, and New York second.

Gliders were also listed. There were 1,270 gliders of which 89 were licensed. Licensed glider pilots numbered 267.

The report is interesting in that there is a decided increase in every item over those released for July of 1931.

Night Flying Formation

ALL naval aviators are now receiving instruction in night-formation flying from the decks of the Navy's airplane carriers. Light, fast pursuit ships of the latest type are used in the after-dark training.

Guide-lights installed on the upper wings enable the pilots to assemble by signal. These lights form a blinker system by which the squadron leader may direct the take-off, once the planes are in formation.

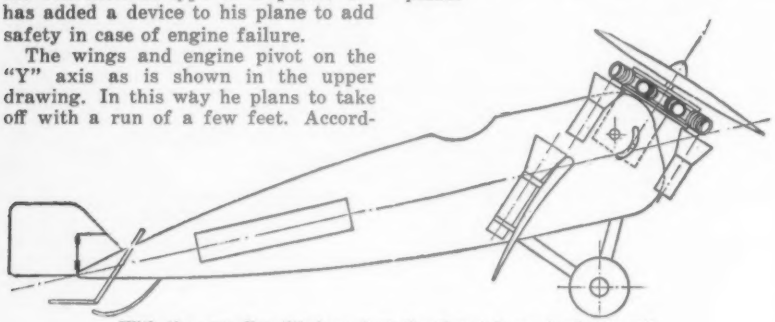
To simplify landing, all carriers have outline lights on their flight decks. A group of signalmen, carrying lighted wands, are stationed at strategic points on the landing deck to guide the descending planes to a safe landing.

The naval pilots are not initiated into night flying on the airplane carriers, but are given a thorough preliminary course ashore. A lighted area, an exact duplicate of the carrier's deck in size and shape, is laid out on the landing field. The same formations for taking off and landing are used. The fliers practice until they become proficient enough to be assigned to ship duty.

Employs Tilting Power Plant and Prop for Lifting

MR. HARRY HUDSON, an inventor in Great Falls, Montana, has invented a plane that combines the advantages of an autogiro with those of the conventional type of airplane. He has added a device to his plane to add safety in case of engine failure.

The wings and engine pivot on the "Y" axis as is shown in the upper drawing. In this way he plans to take off with a run of a few feet. Accord-



With the propeller tilted, part of the thrust is resolved into lift.

ing to mathematical calculations, the plane will ascend at about the same angle as the autogiro.

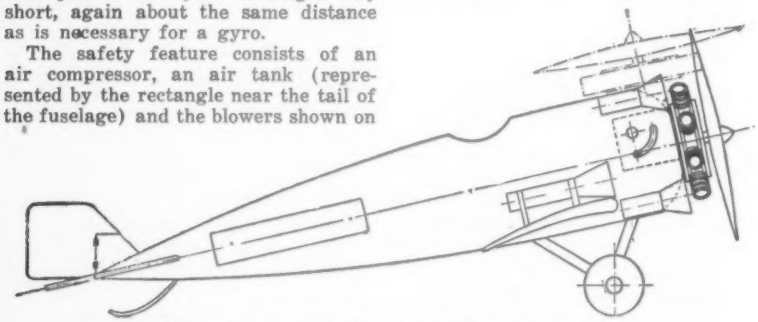
When the plane has risen to a suitable altitude, a lever is arranged to return the wings and engine to the normal position. A counter-balance is included to make this action easy. A small lever, near the pilot, is the control for all movements of the wings and engine.

The engine is turned, as shown by the dotted lines, for landing. No motion of the wings is necessary, for they have an action similar to a parachute. The space necessary for landing is very short, again about the same distance as is necessary for a gyro.

The safety feature consists of an air compressor, an air tank (represented by the rectangle near the tail of the fuselage) and the blowers shown on the wings. When the engine fails, the air in the tank is slowly released through the blowers on the wings, thus adding to the gliding range of the plane.

By careful manipulation of the controls and the compressed air, the gliding range of the plane is increased many times. Mr. Hudson believes that this increased range will allow better selection of an emergency landing field and better control in landing. He claims that many accidents can be prevented every year by this means alone.

The invention has been made up into a working model, and tested in a wind tunnel. These tests have been so satisfactory that plans are now being made for a full-sized model to prove the usefulness of the plane in actual flight.



With propeller as shown by dotted lines, maximum lift is obtained.

Try Out Camera Guns in Army

PATIENCE has its reward as well as persistence, and the First Pursuit Group, Selfridge Field, Mich., has at last been compensated for these virtues by being supplied with twenty camera guns to be used in connection with its tactical training. The guns are operated by a trigger fitted on the control stick, the film roll being actuated by a strong spring.

A test installation was made on a Boeing P-12 airplane and good results obtained. The remaining guns will be distributed to the squadrons and installed in the near future.

It is anticipated that the use of these camera guns in the tactical work will result in many enlightening comparisons. They will aid greatly in the solution of tactical problems of attack, formation and position. Many arguments should be eliminated or at least settled, for on each exposure of the film there appears the exact time of the exposure and the target ship if a hit was scored. Especially important will be the use of camera guns in the work the group will perform in the formative period of two-seater Pursuit tactics. Many interesting and instructive comparisons should result between the guns mounted on the two-seater Pursuit airplanes and the guns fixed on the single seaters.

Airplanes in the Arctic

THE husky and the malamute, tho dependable beasts of the Far Nort are slowly but surely giving way to t airplane, according to Arthur W. Joh son, general manager of the Alaska division of American Airways.

"Planes have just about done awa with dog team travel in Alaska," sa Mr. Johnson. "A plane is able to cov as much territory in an hour as a goo team of huskies can make in a wee Airplane travel is not only much faste but cheaper. The old-timers, or "sou doughs," are sorry to see the dog da pass, but no power on earth can st it—it is a case of economic necessity.

There are about 3000 miles of ai ways in Alaska, points out Mr. Johnso They cover a thinly populated area a most as large as the United States eas of the Mississippi river. Regular serv ice radiates from Fairbanks, reache Point Barrow on the Arctic Ocean White Horse in the Klondike district Nome on the Bering sea and Skagwa in the south.

"Because of low temperatures, man problems arise not found on any othe airway in the world," declares Mr Johnson. "The thermometer often reg isters 70 degrees below zero in winter Frozen banks of snow demand opera tion on skis from five to seven month each year. We land on lakes and riv ers, and in the summer use pontoons t a large extent.

"Skis are used during the spring thaws for landing on mud. We are trying now to develop a good all-pur pose ski. There are different kinds o snow—soft, frozen, crusty, powdery and each requires a different type o landing gear. We have made a good many experiments, but have not yet developed the ideal type. Perhaps we can evolve a sort of amphibian gear with a choice of wheels or skis."

Incidentally, Santa Claus's sleigh got around as usual this Christmas. Mr. Johnson early in November contracted with the Canadian government to transport three tons of food for reindeer in the Arctic zone. The herd was being moved from a government reservation to better grazing grounds further north, and its food en route was delivered by airplane.

Award for Gyro Development

THE annual John Scott award, together with a cash premium of $1,000, has been awarded to Juan de la Cierva and Harold F. Pitcairn for the invention and development of the gyro.

The award was established in 1816 by John Scott, a chemist of Edinburgh, Scotland. The donor bequeathed a fund, the income of which was to be distributed among ingenious men and women who make useful inventions.

The presentation of the award was made at the Aero Club of Philadelphia.

What Our Readers Are Building

A department devoted to our readers' activities in airplane and glider construction.

Seaplane Is A Success

This is the classy seaplane built by C. B. Gilmore.

C. B. GILMORE, 308 Fourth Ave., So. Charleston, W. Va., has been making a seaplane. He has spent almost a year building the plane, using parts manufactured by a prominent maker.

Gilmore chose a seaplane because he lives near a river, and the charges at the local landing field for storage were too high.

He tells us that all his knowledge of airplanes was obtained from magazines. After some trouble and delay, the job was finally completed and a man found to test-hop it. The first hop was a success.

After he was sure that the plane was safe to fly, Gilmore tried to fly it himself. He does not say whether or not he had any instruction. Here is part of his letter.

I was skimming along at a fair rate of speed and it was so thrilling I pushed the throttle as far forward as it would go and the plane took to the air. This excited me somewhat and of course I pushed the stick forward in an effort to land, and took a nose dive in the river.

They Fly Every Sunday

THE Hyannis Glider Club, out on Cape Cod, is a live and going organization. The club has sent us a report of their recent activities. We are passing it on, just as we received it.

Interest in gliding is being kept alive on Cape Cod by the Hyannis Glider Club with headquarters at the Cape Cod Airport, Marstons Mills, Mass.

This is the Hyannis Club in full force, ready for work.

Fred Evans, manager of the airport, is an honorary member of the club.

The club recently completed its first year of existence. Construction of the glider, a primary type, was begun in January and completed in May 1931. Since May, 120 flights have been made without damage to glider or personnel.

The new license, issued by the Registry of Motor Vehicles, carries permission for auto towing. Formerly, flights were made by means of shock-cord launching which necessitated nine men. With the new license only four men are required.

Eight members who had never had flight instruction have been taught to make short hops. At the annual meeting of the club it was voted to accept further applications for membership.

The club is now a member of the New England Glider Association and plans are being made to build or purchase a sailplane to be entered in various meets.

Cape Cod weather has proven ideal for year 'round gliding as evidenced by the fact that, so far, the club has been able to fly every Sunday morning.

This shows fine work. We wish the Hyannis club at lot of success. Keep up the good work.

If any of our readers are interested in writing the club, a letter to H. M. Roper, 2 Graceda Court, Hyannis, Mass., will reach the club.

Flies Up to 4,500 Feet

This is the little monoplane that climbed to 4,500 feet.

HAROLD R. VIA, 167 Fourth St., Beckley, W. Va., has recently completed his light monoplane. Thirteen months of his spare time were filled up with the making of his plane, including the converting of a Heath Henderson. The framework is of welded tubing.

Several expert pilots have flown the plane and call it good, in spite of the rather low powered motor. Mr. Via plans to install an Aeronca engine if he can get one cheap.

If any of the readers have such a motor for sale—we suggest you write him. His plane, No. 11654, has been flown to 4,500 feet elevation.

This is a real record. Let's have some more performance figures.

With the Dawn Patrol

A good view of the glider owned by the Washington Glider Club.

THE Washington Glider Club flies at all times of the day. The photograph shows one of their gliders being towed to altitude by an automobile, at sunrise. The club uses the Congressional Airport at Washington, D. C., for their flying.

Another Lightplane

EDGAR F. MOYER, 428 N. 5th Street, Emaus, Pa., together with his brother and a friend have built this light monoplane. They have powered it with a motor cycle engine. Not being satisfied with the power, the boys are considering the idea of installing a Ford or a Franklin engine.

Edgar says something about wanting to sell the plane. Well, we pass the information along. The price is written in two figures.

A lot may be accomplished by properly tuning up an engine. Perhaps this might help a lot.

We can't see why he should want to get rid of such a plane. It looks mighty good to us. A closer inspection of the picture shows the job to be a clean, neat looking one. Congratulations, Ed, and your partners.—Good work.

And here is the Moyer ship—a neat looking monoplane.

The Pilot—The Bull—The Field

A DEAR old friend has just been dropped into our editorial office. A worthy contributor has sent in the old, old story of a pilot who had to land in a pasture with a hay-wire engine. There were a couple of small boys who came running to see the plane. Over in a far corner of the pasture was a large and nervous bull.

The bull, angered by this intrusion into his privacy, stepped on the gas and taxied over to see why his siesta was disturbed. The pilot, with great presence of mind, grabbed the two boys, speeded up his idling engine and hedge-hopped the plane over the near-by fence.

It is a fine story, but after hearing it two or three times a year since 1909, it is beginning to get a little stale. Even old Baron Munchausen, the original column writer of fame, did not dare use his stories more than five consecutive years.

Well, we have passed the old saw back. We were sorry to do it, for the contributor is one of our old friends. We expect him and the pilot to side-slip in on us again—say about next September. We wonder if he will come in a glider.

A New Electric Wind Vane

MR. B. C. KADEL, chief of the instrument division of the U. S. Weather Bureau, has invented this new wind vane that is electrically connected to a recording instrument placed in any convenient location.

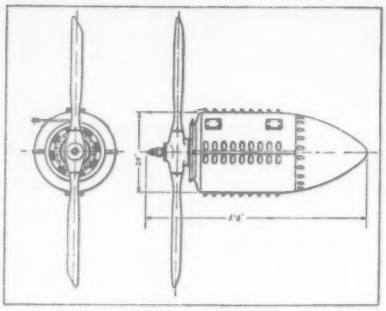
Until this invention was made, it was necessary to climb to the roof to read the wind direction correctly.

The new device is arranged to send electric impulses through wires to a recording device placed in the observer's office or at any other convenient location. Several recorders in different locations may be hooked up to the one wind vane.

B. C. Kadel and his electric indicating wind vane.

Something New in Engines

By NICHOLAS D. BELL



A gas turbine power plant as suggested in the article.

THE airplane and the engine have not reached their final form. They are still in the experimental stage. Future work will be with entirely new types of engines. The airplane itself will not change radically.

This new work must be carried on until man feels just as comfortable and confident in the air, as the bird does. There is nothing that would suggest that this is an impossibility. Only when this happens, then the real Aerial Era will come, bringing with it, perhaps a new kind of a humanity. Let us hope that the change will be for the better, although such an improvement in the aerial navigation may give an impetus also to some imprudent instincts of a man. Some sort of corsairs or privateers of the air may make their appearance once again.

The present flying machine should not be considered adequate from any point of view. They are too big and cumbersome in comparison to the useful load they carry, too fragile and unsafe. The power plants are very complicated and do not fill many requirements of an ideal prime mover. This situation is readily seen in the endeavor of the designers to produce the new flying machines, based on the radically different principles. Information about these projects is appearing in the press quite often.

One solution of the prime mover problem is the adaptation of a gas turbine principle. It seems to fit the aeroplane very well from many points of view. The gas turbine principle while remaining practically unexploited, nevertheless holds the attention of leading engineers and scientists, and is always referred to as a "prime mover of the future". Possibly it will eventually supplant the internal combustion engine just as steam turbines have practically eliminated steam engines from their field. At present, several cities in Europe use large gas-turbine installations of several thousands horse-power each, generating electricity in the central stations. These turbines have operated successfully for a

(*Continued on page* 255)

The Forest-Fire Fighters

By J. M. Hawley

FOREST Fire! The most horrible of calamities. Men, women and children are trapped in the woods. Wild life is wiped out. Stately monarchs of the forest crash in flames.

Valuable timber lands are reduced to a few charred stumps on a hillside. Whole towns are wiped out. Railroad transportation is tied up for days or weeks. Fire! The great destroyer.

The forest rangers employed by the government have been forced to fight forest fire with comparatively crude equipment. The fires are frequently in such isolated places that there are no roads to bring in efficient apparatus. The axe, the shovel, the beater and dynamite are the usual weapons. Water is seldom close to the fire.

Railroad companies, whose rights-of-way pass through forested regions, have fire-fighting trains. The trains consist of an engine with a good water pump, several tank cars of water and a car of equipment. Outside of protecting their own property, however, they are not equipped to do a great deal of good.

Recent developments in aviation, however, have given a new weapon to the fire fighter. The front cover of this issue of POPULAR AVIATION shows a proposed type of airplane that is to be added to the equipment of the forest rangers.

These monoplanes are constructed entirely of metal, except for an asbestos shield around the pilot's seat and around certain other parts that might be affected by the heat. The equipment of these planes is especially designed for this particular work.

Bombs are to be used for fighting fire, both explosive bombs and chemical bombs. Some of the lessons learned on the battle fields are to be applied on the burning forests.

The explosive bombs are loaded with dynamite. This is an old weapon in fighting forest fires. Large burning masses, giving off so much heat that men cannot get close, are blown up into smaller fires that can be extinguished very easily.

Fire-lanes are frequently cut to stop the progress of the fire. These fire-lanes are paths cut through the woods, fifteen to fifty feet wide, and cleaned of combustible matter. A low flying airplane, dropping explosive bombs at intervals, can make a lane several miles long in a very short time.

The chemical bombs are designed to put out a fire by smothering it. They are filled with a special preparation, chiefly composed of carbon-tetra-chloride. These bombs, when exploded, spread a gas blanket for several hundred yards in every direction. The gas shuts out the oxygen and the fire is extinguished.

The plane is equipped with a radio, so that a two-way communication can

(*Continued on page* 258)

How to Find the Center of Gravity

by J. B. RAYFIELD

The author describes two simple methods of computing the location of the center of gravity

AIRPLANES, unlike most other vehicles, must be balanced accurately in respect to their point of support. When the weight of the ship and its lead are hung from the wings, the body should hang in the correct attitude with as little assistance from the control surfaces as possible, because the control surfaces consume power when they are called upon to correct unbalance.

Thus, when a ship is being designed, one of the first calculations made is the calculation for the "center of gravity" or the "C. G.," so that the various weights can be arranged properly around the center of lift of the wings and the thrust of the propeller. After construction, a further adjustment is

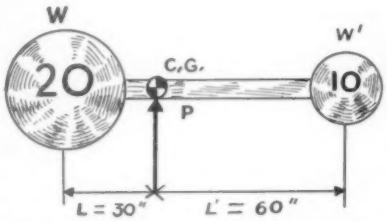


Fig. 4. Balance system—unequal weights.

generally necessary before the ship ceases to be "nose heavy" or "tail heavy."

At the bottom of this balancing proposition is a more or less imaginary point at which all of the weight can be considered as concentrated. This is the center of gravity (C. G.). It is assumed, for convenience in calculation, that all of the weight is located on this point, just as if all the parts were boiled down in size until they occupied the space of a pin-point. With the center of weight located in this manner, it is then comparatively simple to work out the system of balance for the airplane.

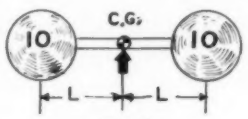


Fig. 1.

Fig. 2.

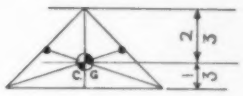


Fig. 3.

In a practical sense, the center of gravity is the point at which any body will balance when supported by a thin edge. To create this condition, all of the material in the body must be acting straight down on the support, with no material—either at the right or left—that tends to turn the body out of its condition of balance or equilibrium.

If we should take the pair of dumb-bells shown by Fig. 1, consisting of two 10-pound iron spheres connected by a bar, it is evident that the system will be balanced when the point of support (P) is placed exactly in the center between the two balls. This point is the center of gravity or "C. G." of the dumb-bells. The tendency of the lefthand ball to turn the body to the left is exactly overcome by the equal righthand weight turning the system toward the right.

In short, if the two weights are equal, then the distances (L-L) measured from the center of the balls to the center of support are equal. If you wish to go into the matter mathematically, then the product of the weight of one ball by its distance must be exactly equal to the product of the weight of the other ball by its distance from the support.

In Fig. 2 we see that the C. G. of a sphere must be at the geometrical center of the sphere because all of the material is located at a uniform distance from the center equal to the radius (r). In the case of the triangle in Fig. 3, the C. G. is located at a point one-third from one side, and if supported at this point the triangle will balance. And so on, with all sorts of figures and bodies, both of simple and complicated form.

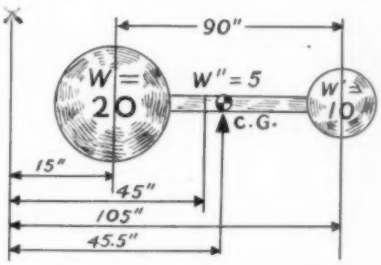


Fig. 5. Three elements balanced.

Now, two of the bodies shown have their C. G. located midway of the figure, hence the bodies are called "symmetrical." The triangle is the exception. This is the simplest condition, but unfortunately most of the parts entering into the construction of an airplane are not symmetrical and a considerable amount of calculation will be required to find the center of gravity.

Our first example of such a calculation will be the casting in Fig. 4 where one of the balls weighs 20 pounds, while the other is 10 pounds. In this case, it is obvious that the point of support (P) must be placed closer to the heavier weight if we desire equilibrium. Common sense will tell you that, but common sense alone will not give you the exact position of the support unless it is arranged by direct experiment.

If we recall the rule given above, however, it will be a simple matter to locate (P) or the C. G. Thus, the product of the weight (W) by its distance (L) must be equal to the product

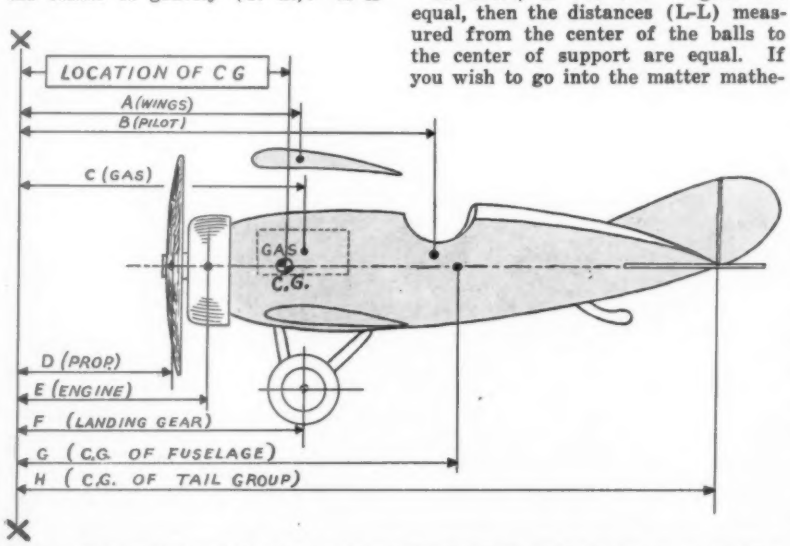


Fig. 6. All elementary weights in the airplane produce couples about the line X—X. Dividing the sum of the couples by the total weight locates the C. G.

of the weight (W') by its distance (L'), or: $20 \times 30 = 10 \times 60$. This is true because $20 \times 30 = 600$, and $10 \times 60 = 600$. In other words, the "couples are equal and opposite."

It should be particularly noted, however, that the distances are measured from the centers of gravity of the two balls, and that the effect of the cross-bar is not taken into consideration in this case for the sake of simplicity. In short, the cross-bar is considered weightless at present.

NEXT, let's take the same casting, but in this case we will take the crossbar into consideration—say that (W") weighs 5 pounds. This third weight will make it necessary to change the simple method of calculation to the method shown by Fig. 5, although the principle remains just the same as before. The unbalancing couples, when added together, still remain zero when in balance. In other words, the tendency of any of the three bodies toward turning to the right are exactly offset by the tendency toward turning to the left.

In starting out, we draw any straight line at random, such as the line (X-X), outside of the body and vertically. In this particular case, we have located the line (X-X) at a distance of 15 inches from the center of the sphere (W), but this can be made any distance that we choose. All of the other dimensions remain as they were before.

The whole proposition is to calculate the couples or turning moments about the arbitrary reference line (X-X) rather than about the individual C. G.'s of the various parts. With this idea in view, we multiply each of the weights by its distance from the reference line (X-X) and add the products together, thus:

Item	Weight	Distance	Products In.-Lbs.
(W)	20 Lbs.	15"	300
(W')	10 Lbs.	105"	1050
(W")	5 Lbs.	45"	225
Total	35 Lbs.		1575

Now, if all of the products are equal to 1,575 inch-pounds, it is evident that the average distance from the reference line (X-X) will be equal to the sum of the products (1,575), divided by the total weight (35 pounds). The location of the center of gravity (C.G.) from the reference line (X-X), will be, therefore:

$$\frac{1575}{35} = 45.5 \text{ inches}$$

We will now measure off 45.5 inches from the line (X-X), and will find that the C.G. is now just one-half inch (0.5 inch) to the right of the original C.G. when we neglected the weight of the cross-bar. In other words, the weight of the cross-bar (W") moved the C.G. one-half inch to the right. This system can be applied to any number of weights or masses, drawing a reference line outside of the figure and then adding the products of the weights by the distances. The total product is then divided by the total weight, locating the C.G. with exactness.

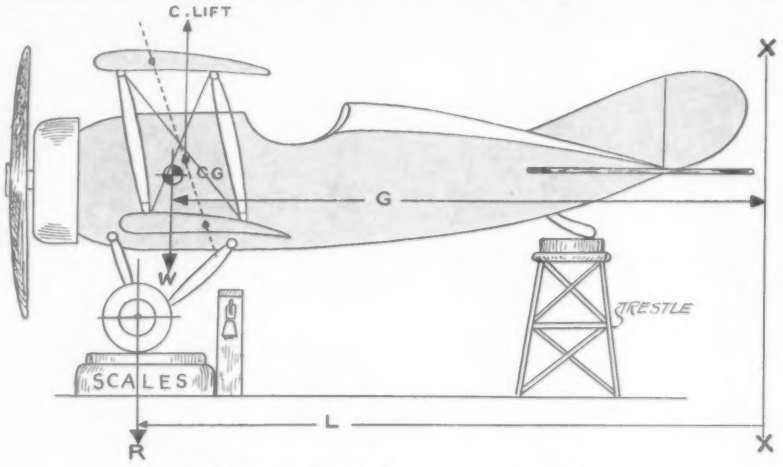


Fig. 7. Determining center of gravity by actual weighing.

NOW, in Fig. 6, we will see how this principle is applied to the location of the center of gravity in an airplane, this being the practical application of the principles just described. A scaled elevation of the airplane is carefully laid out as shown, with the centers of gravity of each principal group located on the drawing. It will first be necessary to arrive at the center of each group of elements before we can proceed.

Outside of the figure is the reference line (X-X) from which all of the distances are measured. Then, we have the distances such as (A) to the c.g. of the wing group; (B) to the c.g. of the pilot's body; (C) to the c.g. of the fuselage gas tank; (D) to the c.g. of the propeller; (E) to the c.g. of the engine, and so on, through all of the items entering into the construction of the ship. After all of the distances are found, they are multiplied by the respective weights of the groups, the total is found, and then this total is divided by the total weight. The result of this division gives the "overall C.G." of the complete and loaded ship ready for flight.

The matter is made considerably simpler if we have the completed ship to handle. This is shown in Fig. 7 where the forward end of the ship is shown on the scales for weighing. This is only another application of the same old principle, but is useful and probably needs some additional explanation.

First, the total weight of the ship is taken, and will be called (W). Then, the ship is rearranged with only the landing wheels on the scales as shown, the rear end of the ship being bolstered up in flying position by the trestle or horses shown at the rear under the tail skids. The vertical reference line (X-X) is now drawn to the right of the ship, and the distance (L) is then carefully measured from this point to the point of contact made by the wheels on the scale.

Then, the weight (R) on the scales, multiplied by the distance (L) is the moment about the reference line. This, divided by the total weight (W) will give the distance (G), or the distance to the center of gravity (C.G.) from the reference line (X-X).

For example, let us say that the weight (W) of the whole machine is 2,500 pounds while the weight on the wheels at (R) is 2,200 pounds. The distance (L) will be assumed as 20 feet. Now we have:

$$\text{Distance (G) to center of gravity} = \frac{2300 \times 20}{2500} = 18.4 \text{ feet.}$$

The distance of the (C.G.) to the rear of the wheels is: $20.00 - 18.4 = 1.6$ feet.

The total weight (W) in this case is the total weight of the ship, or the sum of the loads on the wheels and tail skids. Thus, take the load on the wheels with the scales placed as shown, and to this weight add the load on the skids with the skids on the scales. This is about the simplest method of getting the center of gravity accurately.

Now, the location of the center of gravity in relation to the center of lift of the wings, is rather more complicated than the present calculation. In general, the center of gravity is in front of the center of lift so that there is a tendency to nose down into a glide with the engine cut out. However, this tendency should not be excessive so that the elevator or stabilizer will have much work to do in holding the nose up.

The center of gravity is somewhat to the rear of the center of the landing wheels as indicated, so that the tail will come to rest on the ground. If this distance is not sufficient, then there will be a tendency toward nosing over under certain conditions.

END

XUM

Question and Answer Department

THIS department is devoted to the questions of the readers of POPULAR AVIATION. Any question on the subject of aviation is welcome and will be answered by our staff of experts. Unfortunately we have not space to answer all questions as soon as they come in. Questions are answered in the order received. Please do not be impatient if your questions are not answered promptly. Keep your eye on this department and before long the answer will be printed.

* * *

QUESTION:—George Stoltz, Quincy, Mass. *Can a dirigible be filled with hot air instead of helium?*

ANSWER:—YES, but it would not be practical. The lifting power of hot air is much less than that of helium. The amount of fuel that would be necessary to keep the air hot would reduce the range of the ship.

* * *

QUESTION:—Fred Richards, Spring Harbor, Wis. *How fast is the tip of a propeller traveling when the engine is revolving at full speed?*

ANSWER:—THAT depends on the length of the propeller, and the r.p.m. of the engine. To calculate the speed, multiply the length of the propeller by 3.1416, and the product by the r.p.m. Using this method, the speed of the tip of a 9 ft. propeller, revolving at 1,900 r.p.m., is 53,694 feet a minute, or nearly 10 miles a minute.

* * *

QUESTION:—M. S. Evans, Chicago, Ill. *What really causes the lift of a plane, the pressure under the wings, or the semi-vacuum on the top?*

ANSWER:—THE lift is proportional to the reaction caused by the mass of air, swept downwards by the wings. The greater the weight of air displaced downwards, the greater will be the lift.

* * *

QUESTION:—George North, Houston, Texas. *Why are airplane beams made hollow or deeply grooved?*

ANSWER:—IT IS the purpose of a beam to resist bending. As the fibers on the top and bottom faces of the beam have the greatest power of resisting bending moments, the engineer endeavors to place the greater amount of material on these faces. As a result, the central portions are either drilled or grooved out to remove the comparatively worthless material near the center of the beam. By properly adjusting the grooved out portions the beam can be made very light in weight for a given strength.

* * *

QUESTION:—William Wilson, Hastings, Montana. *Why is the gasoline and air mixture compressed in an internal combustion engine?*

ANSWER:—THERE are two basic reasons. When the mixture is compressed, there is a certain amount of heat generated. This speeds the combustion. The other reason is that vaporization is greatly increased. This aids in more complete combustion.

* * *

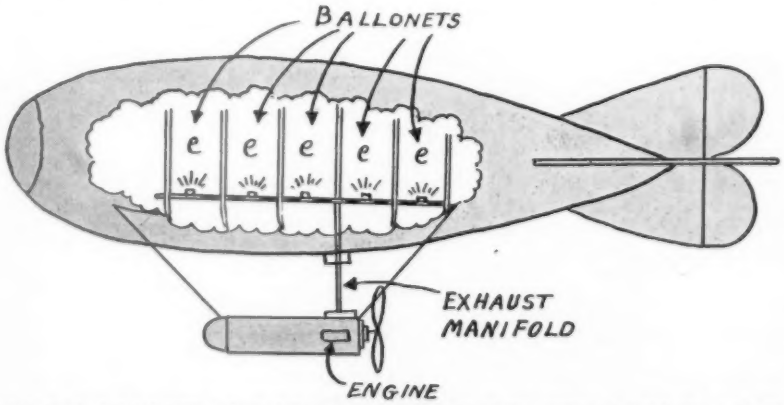
QUESTION:—Francis Argust, Dunmore, Pa. *If an airplane was flying at 400 m.p.h. and a gun were fired, whose bullet attains the same speed, how fast is the bullet traveling?*

ANSWER:—YOU do not give the direction the bullet is traveling in relation to the airplane. If you mean that they are both traveling in the same direction, the bullet will travel at the speed of 800 m.p.h. in relation to earth. If the bullet is traveling in the opposite direction, the bullet will travel at zero miles per hour in respect to the earth.

* * *

QUESTION:—M. W. Paluski, Waverly, Ill. (1) *What is the advantage of being able to do stunt flying?* (2) *What*

(*Continued on page* 254)



A dirigible inflated with hot air taken from the exhaust of the engine. Heated air is shown issuing from the jets (e-e-e-e).

A New Pitch-Checking Device for Propellers

Checking up the blade angle with the protractor.

J. WESLEY SMITH, inventor, of Philadelphia, has designed an instrument for checking the pitch of airplane propellers.

The device is quite simple in construction. A piece of flat brass, about eight inches long, has a hook at one end. On the other end is attached a small protractor. On the protractor is a small pointer with a leveling bubble. In use, this instrument is hooked to the propeller, as is shown in the illustration, and the pointer moved until the bubble is level. The pointer reading shows the pitch of the propeller blade.

Uncle Sam Guards His Payroll

THE residents of Riverside were awakened early one morning by a low flying bomber. Rushing out they could plainly see the two machine gunners at their posts—front and rear. They wondered greatly at the sight, but time revealed that the ships were guarding the $80,000 payroll for March Field.

Besides the bomber and machine gunners, six armed men accompanied the car which carried the money from the First National Bank to the field.

Uncle Sammie is getting wise, it seems, taking precautions against those who may have aspirations toward his possessions.

Strawberries by Plane

ENGLAND and Germany had strawberries out of season for the first time early this spring, thanks to the airplane. Crates of them were transported from Holland by plane, and so great was the demand that many large orders could not be filled because of the shortage of freight planes. One company is now rushing construction of three freight planes to be used in future berry transportation.

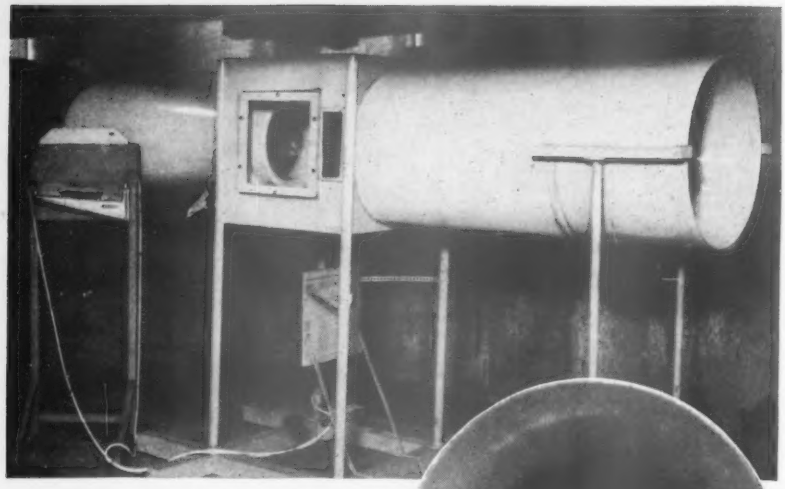
A Home-Made Wind-

by

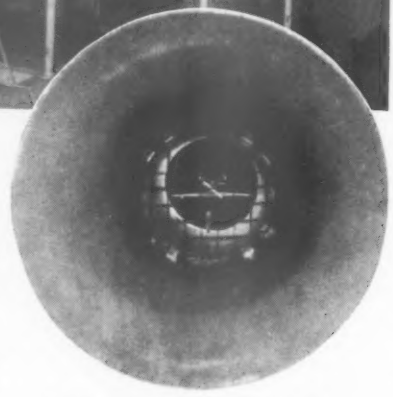
E. W. Luker

+ + +

Built by
JOSEPH LISTON
and
A. D. OLIVER



Side elevation of the completed tunnel.



Looking at the bell-mouth opening.

EMBODYING the latest in aeronautical research, and capable of developing a wind speed of 135 miles per hour, this practical, small-sized wind-tunnel is being used to find the efficiency of wings, gliders, and airplanes.

A model of the craft in question is subjected to a series of tests within the chamber. Since it is desirable to know whether or not a plane will fly before risking a crack-up, wind-tunnels play an important part in the safety of aviation.

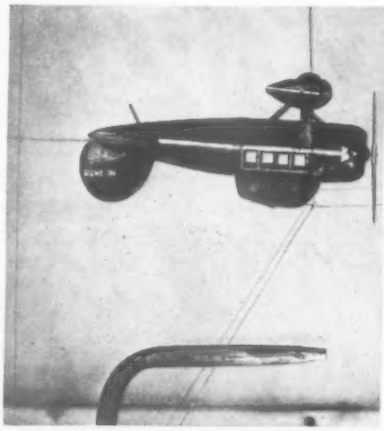
It is extremely difficult, if not impossible, to derive from pure mathematics, the forces that act upon a craft under certain given wind velocities. Therefore, these forces must be found by experimentation, and since natural winds cannot be controlled, a wind-tunnel must be used to create, control and direct winds in order to carry out the experiments.

It can readily be seen that a stationary object would be much easier to work with than one that is speeding through the air. Wind-tunnels of this type are capable of causing the air to move against the object, instead of the object against the air, but the same results are obtained. By suspending a model in a wind-tunnel and directing winds against it, its lift, resistance and balance can be easily determined.

Of course, the models tested in this tunnel are necessarily small, but by increasing the ratios of lift, drag and balance proportionally, as the size factor is increased, mathematical relationships can be accurately established for any sized plane or wing.

When a model is placed in an inclosed chamber, allowances must be made for static pressure caused by drafts creating a slight vacuum as they are drawn into the tunnel. The static pressure within the tunnel corresponds to the natural air pressure on the outside, but it is slightly smaller.

This tunnel was built by A. D. Oliver, graduate student and Joseph Liston, assistant professor of mechanics, both of the University of Oklahoma. The construction was under the joint sponsorship of the local chapter of Tau Omega, national aeronautical fraternity and the mechanical engineering department of the University. The entire cost was but little over $100.



Model under test and upside down. Pitot tube directly below it.

It is of the open throat type, and consists of an entrance cone made of wood, a length of straight pipe, a cubical test chamber, an exit cone of sheet metal and a fan with an engine to draw the air. The wooden entrance cone is 27 inches in diameter at the large end and then tapers down to 12 inches where it is joined to a 36-inch length of straight pipe made of light weight sheet-iron, which in turn enters the test chamber through a packing gland.

THE test chamber is in the shape of a cube, 30 inches on the side. It is made of heavy gauge galvanized sheet-iron, welded to angle-irons to form the cube. Windows 18 inches square, on each side, allow both visibility and access to the chamber. They are of triple-strength glass set in wooden sash. Felt packing is used between the window sash and frames to prevent air leaking into the chamber.

An exit cone, also made of heavy gauge galvanized sheet-iron, is 60 inches long. It tapers from a diameter of 27 inches at the test chamber connection down to a diameter of 15 inches at the fan connection. The connection between the exit cone and the fan is a heavy canvas tube, held in place by a hoop on the exit cone and a hoop on the fan flange.

This canvas connection prevents the transmission of vibrations from the fan to the test chamber, and also avoids the loss of air around the end of the exit cone. The fan is a 40-inch paddle wheel suction type. The driving unit is a six-cylinder automobile engine with its clutch and transmission replaced by a short shaft carrying a pulley. Power is transmitted from engine to fan by a 6-inch leather belt.

Due to violent vibrations developing in the fan and engine as a unit, the engine cannot be run at full throttle,

Tunnel for $100.00

Heretofore, many experimenters and schools have needed wind tunnels, but the cost of this device has been far out of their reach.

This article, however, shows how the problem is easily solved by providing a reliable tunnel for the almost unbelievable price of $100.

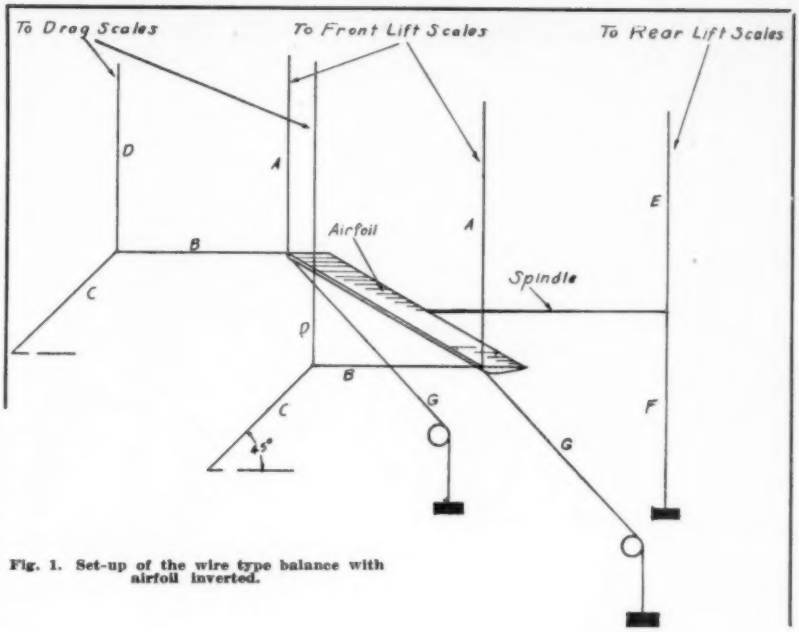


Fig. 1. Set-up of the wire type balance with airfoil inverted.

but even at that, a wind velocity of 135 miles per hour is attainable. If the engine were to be replaced with an electric motor, speeds approaching 200 miles per hour probably could be obtained.

The entrance cone and test chamber are supported by six legs made of 2-inch pipe. The lower ends of these legs end in pipe floor flanges which are screwed to a wooden frame made of "four-by-fours". The large outer end of the exit cone is suspended from the ceiling by an iron strap.

The fan is mounted on the rear end of the engine frame and the engine is placed under the exit cone. An outlet for the wind is cut in the fan covering. The engine is mounted on 5-inch I beams which extend a sufficient distance beyond the rear end of the engine to accommodate the two bearings necessary for supporting the short pulley shaft which drives the fan. The fan mounting is made of heavy steel strap and 3-inch channel-iron, cross-braced with ½-inch rods and light steel straps.

Since the velocities attained in the tunnel are too high to be measured by an anemometer or "wind-speed clock", a pitot tube is used for that purpose. This device measures both the static and velocity pressures. When the open end of the tube is presented to the wind stream, the pressure existing in the tube is the sum of the static pressure and the impact or velocity pressure. An outer pipe carries only the static pressure.

When the ends of the pipe and tube are connected to the opposite ends of an inclined manometer, the total pressure from the tube will counteract the static pressure from the pipe and the velocity pressure may be read in terms of inches of water.

This pressure, when substituted in the formula $M.P.H. = \frac{60}{88} \times 62.2 \sqrt{\frac{h}{m}}$ gives velocity of air in miles per hour. In this formula (h), is the velocity pressure in inches of water on the manometer scale and (m) is the ratio of the air densities.

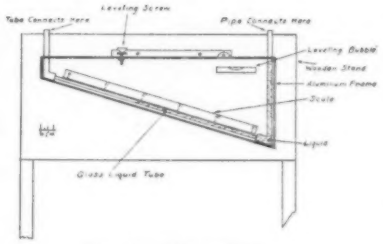


Fig. 2. The manometer.

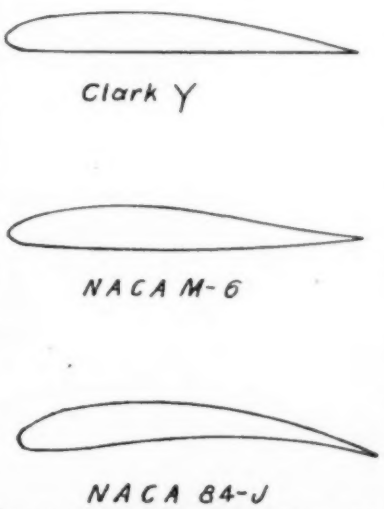


Fig. 3. Typical wing sections tested in wind tunnel.

THE pitot tube is run through a swivel joint in the floor of the test chamber and can be raised or lowered, or moved right or left to any position desired. In this way the velocity can be checked at any point in the chamber.

It is essential for the air to flow with constant velocity through the chamber during the time a test is being made, and it is also essential for the air to be free of whirls and rotating effects. Smoke, made by blowing ammonium hydroxide vapor through hydrochloric acid, was used to discover a few minor whirls and eddies in this tunnel.

When straightening vanes were introduced into the mouth of the entrance cone, these turbulences disappeared. The vanes were made of light gauge galvanized sheet-iron, and resemble the spacers used in egg crates. The openings are 1¾ inches square.

Fig. 1, shows the set-up of the wire type balance used in this tunnel. This type of balance has proved very satisfactory for testing either large or small models in high speed tunnels. By referring to the diagram, it can be seen that the two wires (A-A) one from each end of the airfoil, run upward through the ceiling of the test chamber to the front lift scales.

Wires (B-B) extend horizontally for several inches before joining the wires (D-D) attached to the drag scales and to (C-C) which have their lower ends rigidly fastened to the entrance cone

to form angles of 45 degrees with the horizontal.

A "sting" or "spindle" is fastened to the trailing edge of the airfoil and carries two wires at its free end. (E) also runs vertically upward through the ceiling and is attached to a third pair of scales. The wires (F) and (G-G), dropped through holes in the floor of the test chamber, have weights attached to their free ends. (F) hangs vertically, while (G-G) work on pulleys mounted on the outside of the chamber.

All connections between wires are called "pin joints", and their nature is such that no bending can be transmitted from one wire to another. Piano wire, having a diameter of 0.020 inch, is used in the set-up. The joints are made by forming very small loops or rings in the ends of the wires and then hooking the loops together chain fashion.

The wires (A-A), being vertical and pin-jointed, can carry only vertical pulls. The wires (B-B), being horizontal and pin-jointed, can carry only horizontal pulls. It can be proved that the wires (C-C), running downward at an angle of 45 degrees with the horizontal, cause the vertical pull in the wires (D-D) to be equal to the horizontal pull in wires (B-B).

Therefore, the drag of the entire system of wires and airfoil is weighed in exact amount by the scales attached to wires (D-D). The wire (E), being vertical, can carry only vertical pulls like the wires (A-A). Therefore, the total lift, which acts downward due to the airfoil being inverted, is the sum of the scale-readings of the front and rear lift scales. The wires (F) and (G-G), carrying weights at their lower ends, are used only to put enough tension on the wires of the system to prevent their being blown out of position by the air stream.

IT IS necessary to make very accurate measurements of the drag forces acting on the wires, so that they can be subtracted from the total drag to get the resistance of the airfoil.

The scales, for measuring the forces exerted on a model under test, are of the trip type and capable of weighing to 1/10 of a gram. They are situated directly above the test chamber on a platform suspended from the ceiling. This arrangement necessitates the mounting of the model in an inverted position so that the lift and drag forces will act downward.

Exactly the same results would be obtained if the set-up were to be inverted, the model placed right-side up and the scales situated under the test chamber. With that arrangement, the lift and drag forces would, of course, work upward but unless a different type of scales were used, a more complicated system of pulleys for leading the weighing wires to them would have to be used.

Before a test is made, the model is mounted as shown in Figure 1, and the weight of the entire set-up is counterbalanced on the three sets of scales. Then, as the air is drawn through the tunnel and the model is forced downward and backwards, the scales will be thrown out of balance.

If, say, to again bring the scales to normal, weights of ¼ pounds, 1½ pounds and ½ pounds are required on the drag, front-lift, and rear-lift scales, respectively, the model will have a lifting power of two pounds, and a resistance of ¼ pounds.

Therefore, a wing or plane 100 times

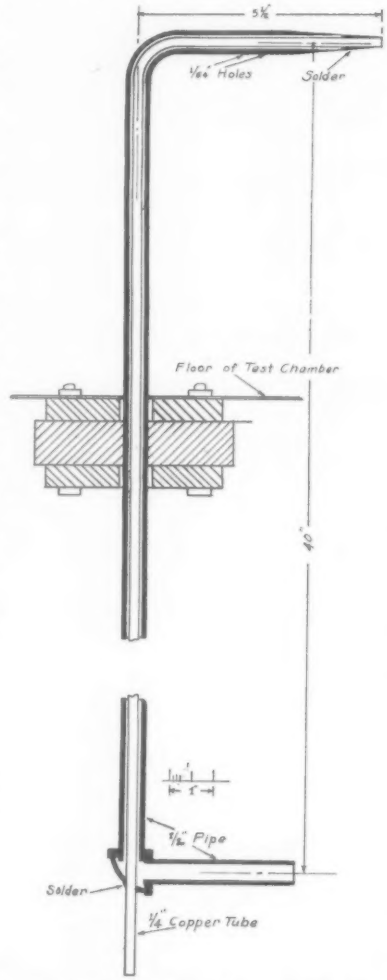


Fig. 4. Details of the Pitot tube used for measuring the velocity of the air flowing past the model.

the size of the model under test would have a lifting power of 200 pounds, and a resistance of 25 pounds. A plane 200 times the size of the model would have a lifting power of 400 pounds, and a resistance of 50 pounds, etc. In this way the efficiency of any sized plane or wing can be found.

This is not only a piece of experimental apparatus to be used for private work. It can also be made a source of profit, testing out various wing sections, models, etc. It is accurate and reliable.

END

The 1932 National Aircraft Show

THE development of airplane parts, instruments, and accessories in this country has been so rapid as to make the United States the leading nation of the world in this field.

Due to the great work of aviation engineers, the many obstacles of man-made flight are being overcome rapidly. During the next few years it is probable that pilots will scorn the natural enemies of the airplane, such as fog, mountains, and storms. They will then be as harmless as they are now dangerous.

A list of all the useful inventions for promoting safety in aircraft that have been announced during the last two or three years would require volumes. Among the most prominent and best known are such inventions as the Sperry Artificial Horizon and the Sperry Directional Gyro, a compass, which was used by Lindbergh in his recent flight to the Orient, and by Post and Gatty in their race against time around the world.

Another instrument that spells safety and comfort for today's air travelers is the two-way radiotelephone by means of which the pilots can receive valuable information as to the flying conditions ahead of them.

These are some of the more important exhibits that are to be shown in the National Aircraft Show of 1932, which will take place in Detroit, April 2 to 10.

Other interesting exhibits will be several new altimeters, including the new sonic-altimeter of the Western Electric Company, several turn-and-bank indicators, and the mechanical robot introduced in 1930, which actually flies the plane for the pilot.

This year's show will be under the personal management of Ray Cooper, manager of the Aeronautical Chamber of Commerce of America, who managed the exhibition of 1931.

Flying Mail Cars

THE postal officials are considering a plan, which may result in America's first string of flying mail cars. This would result in a tremendous saving in time and money, as the clerks could classify the mail while the plane was in flight.

The modern air mail plane is large enough to accommodate one or two clerks, who would work in the same manner as the postal clerks do on the railway mail cars. Racks and pigeonholes would be installed in the cabin and the clerks, by sorting the mail according to address, would eliminate a great deal of delay in delivery when the destination is reached.

There has been a satisfactory increase in air mail during the past year and the postal officials believe that they will soon be able to equip some of the planes with the necessary sorting equipment.

The Daily Life of a Transport Pilot

by CAMERON T. ROBERTSON

as told to Stuart E. Knuepfer

Mr. Robertson gives an interesting account of his early training and of the routine work of a commercial pilot.

LIKE most boys, aviation was always the great love of my life. I read with avid interest everything I could get on the subject and thought that a pilot lived a life totally removed from that of ordinary mortals. After the period of worship had passed I began to think seriously of aviation as a future, but I didn't know how to take my first step.

One day, however, a chap by the name of Murray Hall came down to Fayetteville with his buddy. They arrived in a National Guard Jenny to do some work for the University of Arkansas and, of course, I was around the field. I asked him to tell me the best method of breaking into aviation.

Hall told me to try and get in the Army training school at Brooks Field, Texas. He said it was one of the best types of training in the country for the young man. I took his advice and after some political pull, I was finally appointed by the congressman from my district. I was fortunate to get through the strenuous entrance examination and my active schooling soon began.

I stayed at Brooks Field from March 1st, 1927, until August 5th, of the same year. They graduate you from Brooks and pass you to Kelly where the training is advanced. Nothing of especial interest occurred here. Graduation took place at Kelly on Feb. 6th, 1928, and I received my certificate the same day. Don't think that piece of paper didn't look like a million dollars to me!

I will always rank the Army training school with the best in the world and I still feel privileged to have been passed by it. The grind had been long and strenuous with only 13 per cent of the starting class, graduating.

AFTER leaving Kelly Field, I went to Little Rock, Ark., and was commissioned as Second Lieutenant, National Guard, 154th Observation Squadron. I stayed there for a short time, did some barnstorming and finally went with the 1st Pursuit Group at Selfridge Field, Mich. That was real sport and real work.

At that time, the pursuit group had just about everything they wanted and each day would bring something new for us. You can imagine the type of flying we would do; formation, smoke screen, dog fights, trips to other airports and so on.

I left Selfridge on Oct. 6th, and was hired by the Canadian Colonial Airways immediately after. I flew the route from New York to Montreal, using two different ships alternately; a Wasp powered Fairchild and a Pitcairn. I stayed with this line until an opportunity to become connected with National Air Transport presented itself.

C. T. Robertson—Pilot.

I was then hired by Mr. E. P. Lott who gave me one of the most unusual routings I ever hope to have. I made a shuttle trip from Hadley to Newark, N. J., using a small Pitcairn PA-5. The NAT pilots refused to land at Newark because of the condition of the field; they insisted it was too dangerous with their heavy loads and used the Hadley field.

As a result, I flew the connecting mail, picking it up at Hadley and shuttling over to Newark where I would pick up a load for our next pilot coming through the former town. It was only 18 miles and I made an average of three trips a day. No sooner would I get the tail off the ground than I'd be setting her down at Newark.

FOR four months, I flew this exciting route and got to know every blade of grass on the way. I knew the cows so well that whenever I'd see a new calf, I'd feel like tossing a box of cigars to the proud father.

I was watching airmail and passenger flying develop with leaps and bounds. Even though I was "puddle jumping" all day long, I was playing a three legged game of watching, waiting and learning. And let me say that the younger chap who has his eye on aviation for a future must keep himself constantly informed as to what is being done.

At any rate, I received orders from Chicago to pick up a ship in the east and fly it back to Chicago. On arriving, I was assigned to a regular mail route from Chicago to Cleveland. It was on this route that I really became versed with the remarkable order and disciplined safety of regulated flying.

FOR example, let us take the danger of adverse weather conditions. To begin with, the company will never order you to fly in bad weather and will occasionally prohibit your taking-off. In other words, your own good judgment together with your experience in flying through all sorts of weather should speak for your decision.

When you reach the field, there are complete weather reports for your information and guidance. Once in the air, you have at your disposal—using the Chicago-Kansas City route for an example—26 stations including those on other airways, whose reports on weather in their vicinity are of help to you.

The radio equipment allows the pilot to make his reports in an ordinary tone of voice and to receive information whenever he requests it from his own company or from the Department of Commerce weather broadcasting stations along his route.

If I were in the air and I picked up a report of bad weather that had suddenly kicked up and was heading my way, I could choose any of the regular or emergency landing fields within a short flying distance and be safely landed long before the storm broke.

Weather has been, is, and undoubtedly always will be, the bull in the china shop. Yet, the modern instruments enable the pilot to fly blind with almost absolute safety when there is no danger of ice formation and when good weather is ahead. With the additional assurance of radio information, the hazard is greatly minimized.

I don't believe that the average person realizes the amount of care and supervision necessary to give every airport and every pilot full and complete weather reports. We cannot regulate weather but we can escape from its dangers by being forewarned.

SPEAKING of weather reminds me of the first time I had to do quite a stretch of blind flying. Coming out of Moline, Ill., one night and flying a mail plane, I ran head on into a stretch of heavy snow. I had practiced instrument flying a number of times previously by picking out a group of clouds, diving into them and getting along as best I could. I knew that.

sooner or later, I would have this type of flying to contend with.

Well, this heavy snow scattered my wits a little and I certainly had a solitary picnic all to myself. I kept an eye peeled on the bank-and-turn indicator, but trying to keep it on the spot was like trying to hold a batch of mercury on the end of your finger. It was sliding from one side to the other and I began to realize why some people get such a kick out of merry-go-rounds.

The physical sensations that one has flying blind, especially for the first few times, are strange. Your own sense of direction contradicts the instruments on the board and almost forces you to disregard them. I believe that was the cause of my distress this time: I found it impossible to follow the indicators.

After a period of time, I gave up the idea of trying to keep the plane sober and I headed for the upper strata where I hoped the clouds and snow would end. This also turned out to be a mistake because there was no top to be found. After gritting my teeth for a few minutes, I at last straightened out the plane and flew into clear weather.

Instrument flying takes constant practice and should not be resorted to except when conditions are right for this type of flying. To a well trained pilot it is a comparatively simple means of flying. To a novice, well, it is very difficult.

LET me say that flying is safe. I've had 3,000 hours in the air. Outside a few incidents which were more humorous than tragic, I have had no serious trouble. And these incidents occurred when I was alone and flying mail—not passengers.

Now let me describe the preparations for a typical flight. Say that I am due to leave on my present run, which is Chicago to Kansas City, at four o'clock in the afternoon. I make it my business to get to the field a full hour ahead of time. The first place I head for is the office where the weather maps and reports of flying conditions are located.

I note the wind speed, the direction and movement of the pressure areas, the temperature readings and what poor flying weather—if any—has been reported. I look at all the reports, not only those directly on my route, but also those from outlying stations because, in many instances, this knowledge is invaluable.

After making a thorough study of all these things, I am given a report to sign. Listed on this report are the latest weather dispatches for my route, the amount of gas and oil with which the plane has been fueled, the time set for departure and miscellaneous data.

THE locker room is my next stop. I pick up my heavy outfit and my uniform. When I fly the passenger plane I wear a lightweight uniform.

(*Continued on page* 264)

Membership in the Dumbell Club

A LETTER from Pardoe Martin, 1st Lieut., Air Corps Adjutant, Mitchel Field, N. Y., to E. C. Schnurmacher, 1st Assistant Chief Sleuth, POPULAR AVIATION.

Dear Sir:

Your letter requesting permission to photograph the "dumbell trophy" has been received.

Engraved upon the trophy is the name of the officer who last received it. As you can readily see, a picture used as you suggest, would cause considerable publicity that would be both embarrassing and distasteful to the man concerned. It would not be quite fair for us to put him in that position. Under those conditions I feel that I must deny you permission to photograph the trophy.

Hoping that you will understand our position in this matter, I am

Pardoe Martin,
1st Lieut., Air Corps
Adjutant.

And then came the answer, four months later, somewhat tardy, but then—

* * *

Dear Lieutenant:

For four long months, the readers of POPULAR AVIATION have been waiting with bated breath. It is not only to see a picture of the jealously guarded dumbell trophy, as mysterious, indeed, as the plans for the new 500 mile an hour Zipperino, but also to hear some of the breezy chronicles surrounding that trophy.

Drawing of the jealously guarded dumbell trophy—names deleted.

You will realize, of course, that the Great God News is insatiable. For four weary months we have been waiting . . . waiting . . . undaunted by your refusal to cooperate. And then came the great opportunity. Do you remember, last Friday, when one of your flying Captains with spurs on, tripped over the bear rug in the Officers' Club and gouged out the right eye of the bear? And remember how you immediately phoned for a Bear Rug Optician to replace the eye?

Well, Ha! Ha! and again, Ho! Ho! The chap who answered your call wasn't a Bear Rug Optician at all. No indeedy, and you needn't bite your fingernails either. It was none other than the First Assistant Sleuth of POPULAR AVIATION who sneaked past the guard disguised as a Trumpet Stuffer!

And we got a picture of your famous dumbell trophy. Yessirree. Here's an artist's sketch of it right on this page. What is more, we found out why that trophy is so jealously guarded. Naturally, you don't want to admit that some of you army flyers make boobs of yourselves just as much as some of our civilian dubs. And, my dear Lieutenant, you do, you know!

Let's see. Wasn't it Major A. C. Ertain who had his name engraved on that trophy for landing an amphibian at Mitchel Field without bothering to lower the wheels first? And didn't that crate spill beautifully? And was the Major's face red? So red, indeed, when he left Mitchel Field for the office of the Chief of Air Corps, that the inscription plate on the dumbell trophy disappeared about the same time. Quite a coincidence, wasn't it, Lieutenant?

Then again, how about that Reserve flying officer who, when he ran out of fuel in his main tank, casually switched over to one that wasn't even attached to the plane? And you mean to tell me that such things happen only in books or civilian flying? Fie on you, Lieutenant.

What about the delightful escapade of Flying Warrant Officer Dodd? You remember that he started out with a formation of five planes to fly to Middletown, Pa., from your rancho and instead, he gracefully landed at Aberdeen, Md. And you know the staff officer who was his passenger on that memorable jaunt? That staff officer, What's-His-Name, afterwards claimed that he knew all the time that Dodd was heading for Aberdeen, but didn't say anything because he thought that Dodd was really a new Major who was just reporting to Mitchel Field!

Ah, Lieutenant, you blush prettily indeed! So prettily that I hesitate to mention the occasion on which a member of your Officer's Club socked a judge with a rock during a bombing contest at Roosevelt Field. Because the one pound bags of flour weren't heavy enough to zip straight down, that officer wasn't taking any chances. Nosirree! He put a good big rock in each bag, and the damphool judge who was scoring stood right in the middle of the mark, received the officer's rock right on the toe. His yell, and pathetic wail, "it's a good thing that cows don't fly" is a Long Island flying epic to this day.

END

XUM

Don't Try This Stunt

ROBERT QUIGLEY learned that his wife in Hammond, Ind., had sworn out a warrant charging non-support, so he fled across the line into Illinois. Then he bought an airplane, and made frequent trips back to Hammond.

He glided down over his wife's house, waving derisively before flying back to the safety of Illinois. But he made one trip too often. The plane nose-dived into a tree and a warrant was served on Quigley who had escaped unhurt—and the Missus had the last laugh.

Air-Survey Flight to Open Northern Africa

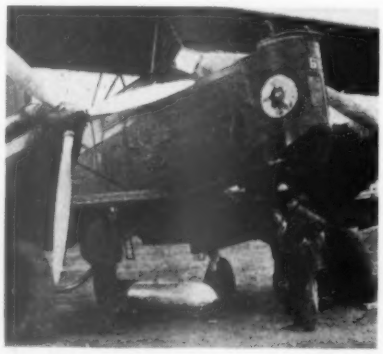
ON January 11, Lieut. Atcherley, R. A. F., took off at Cairo, Egypt, as commander of a survey expedition, which is to chart African air courses between Cairo and Zanzibar. His fleet consisted of four day bombers. The route will include Khartoum, Juba, Entebbe, Kisumu, Nairobi, Mombasa, Dar-es-Salaam, Lindi and Zanzibar. Flt.-Lieut. R. L. R. Atcherley is a Schneider Trophy pilot, and a winner of the King's Cup. Ultimately, private flying will be possible along this route as a result of this exploratory work in the air.

Loading a Large Bomb

THE Army Air Corps has just sent us this picture. It shows a bomb being fastened under the fuselage of a bomber just prior to taking off.

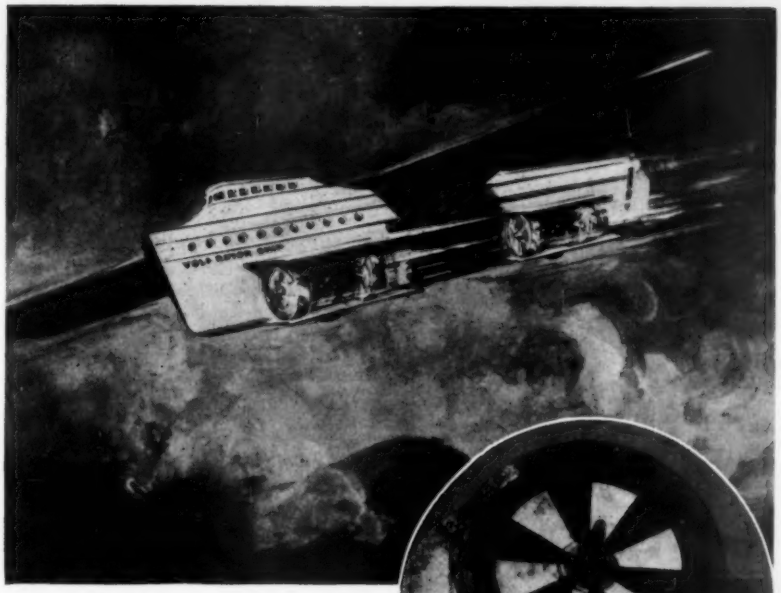
This bomb is one of the largest now in use. The destruction when this lands is terrific. There is little chance for any living thing to exist within a radius of several hundred yards, and it is probable that anyone within a half mile would be killed. Property damage would be heavier than with an earthquake.

Note the glass floor in the front of the cockpit, enabling the pilot to see his target better. Just below the glass panel is a pair of landing lights, making night bombing possible.



Loading a large bomb on the bomb racks of the bomber.

Rotor Ship Unleashes New Speed Limits



Schematic drawing of rotor ship in flight.

Detail of rotor.

AN AIRPLANE without a screw propeller, elevators or ailerons of the conventional type, is being projected in the development laboratories of Dr. Christian A. Volf of New York City. It is expected to unleash hitherto unknown speeds for aircraft.

Laboratory tests, already made, indicate that the craft will have not only high speed, but also the ability to carry a greater commercial load. Taking the place of the screw propellers will be high speed rotors placed along the hull —four on each side with the larger ships.

Above and below the rotors will be longitudinal wings in addition to the flight wings. These auxiliary wings will be in three sections, two directly over the rotors will be movable and the center section stationary. Changing altitude, taking off or landing is accomplished by moving the rotors and casement wings.

The secret of the whole thing is in the rotors; which have been fully patented, covering more than 100 uses. The rotors were designed for use wherever air is handled at high speed. Where is air handled at high speed, more than in airplanes?

An advantage of the rotor is that it cannot be over-spun. There is no limit —the propeller will not act as a brake at high speeds, tending to decrease the forward motion of the craft. It cannot chop the air. At least, not with any engines in use today. This is because it is based on the principle of the flat plate.

It is the flat plate principle which Volf discovered could be applied to modern uses. He came upon it with a phonograph record. The record was spun until it reached a speed of 2,000 revolutions per minute. Then the plate lifted from its table and went straight up into the air. When it came down, it turned, slipped and fell. But its upward motion was direct—apparently overcoming gravity by motion.

As far as could be learned, this type of force was not known before—at any rate, it was not exploited. It taught that were it possible to revolve a flat plate disc large enough and fast enough it could lift a plane directly off the ground without any take-off run.

This flat plate tendency is illustrated in the big Dornier Do-X. In this ship there are four-bladed propellers nine feet long with a very small pitch. Volf believes that in the future, speed records will be made with propellers having no pitch or angle. They will be absolutely flat on the intake side. Pull or force will be attained through scientifically correct hollowing out of blades on the exhaust side. Those who have seen the rotor believe Volf has hit upon the solution of use of "flat plate" rotors.

The flat plate rotor is limited only by engine speed. It will exert a working force at every known present-day speed. When engines are built for higher speed than are used at present, with a workable lubrication system for tremendous speed, then will the speed

(*Continued on page* 257)

The Round Robin Club

A correspondence plan for POPULAR AVIATION readers.

THE Round Robin Club rolls merrily on. We are glad to announce two new clubs this month, No. 15 and No. 16. Here are our greetings.

Again we have some letters without addresses. Sorry, but we can not include them this month. Just have no idea where to send the Robin.

We have a letter from member (6) of Club No. 7. Somewhere the letters are tied up. He has written to several members of the club, but the R.R. is still missing. Who has the letters of Club No. 7? If the list of addresses is lost or mislaid, write to POPULAR AVIATION and we will send a new one.

Here is another Q.S.T. (as the radio fans call it). Raymond Nowrot of Grand Rapids, Mich., will you please send your correct address to Dewain Palmer, 508 Center St., Clio, Mich. He sent the Robin to you twice but it was returned. Please send your address so that he can send the letters to you on the next round. If he does not get the address he will send the letters to P. A.

Here are the new clubs, and the new members.

No. 15: (2) Robert Mattison, 614 6th St., Brookings, S. Dak.; (3) Mary E. Friars, Loch Lomond Road, St. John, N. B., Canada; (4) Harry Cramer, 127 Clarence Ave., Syracuse, N. Y.; (5) Fredrick A. Steller, 801 N. Walnut St., Madison, Indiana; (6) Lee Gillette, 971 E. 31st St., Brooklyn, N. Y.; (7) Arthur L. Halstead, 3 Spring St., Xenia, Ohio; (8) Bob Johnson, 409 Davis Ave., Oakland, Neb.; (9) Fred Krug, 330 E. Westfield Ave., Roselle Park, N. J.; (10) Stephen Wesol, 9108 110th Ave., Ozone Park, N. Y.; (11) Emil Cirubnick, 65-31 Woodside Ave., Woodside, N. Y. C.

Club No. 16 is composed of: (2) B. Howard Duncan, Box 265, Roxboro, N. C.; (3) P. Clifford Teach, 468 W. Exchange St., Sycamore, Ill.; (4) Arlie Backer, Route No. 4, Greenwood, Wis.; (5) Alvin Cooper, Route No. 2, Doland, S. Dak.; (6) B. W. Drummond, 6608 Huber St., Detroit, Mich.; (7) Russell J. Heide, Rhame, N. Dak.; (8) Robert J. Whelan, Jr., 62 Whitehall Blvd., Garden City, N. Y.; (9) Lea Parret, Northboro, Iowa; (10) Al Mattson, Box 16, Independence, Wash.; (11) Thomas R. Lawrence, Box 52, Mayville, Mich.

We have received a few letters asking why the writers have not become members and assigned to clubs. We always list the new members and assign them to clubs in the first issue after we receive the letters.

Sometimes letters go astray and we never get them. If your name does not appear, when you think it should, write us another letter. Please tell us that you have written before.

Quite a few members have written in to tell us what they are doing. We are glad to get these letters. Two fellows wrote in the other day to ask what it costs to be a member. All it "costs" is to keep the Robin moving—sending the letter to the next member as soon as possible. Just write down your ideas and any aviation news you think would be of interest to the others.

Someone (no names mentioned) wrote in to be a member and asked for an autographed photograph of our excellent friend, and sponsor of this club—Mr. John B. Rathbun. We are sorry. J. B. is very modest. He has had to make it a rule that he sends out no more photos of himself.

It seems that he did send one of his photos to an admirer and it got mixed up in a beauty contest. It was very embarrassing when the judges called for Miss Rathbun. Well, that is the story and J. B. sticks to it.

Word has just come to the office that Club No. 4 has crashed somewhere and did not come in on time. Let's go! ! ! ! Somebody! ! ! !

That is all for now. 'Till next month. Best O' Luck. J. M. H.

Army Planes Make Fast Hop

IN a recent trip from San Francisco to March Field, which lies 410 air miles to the south, nine bombers made fast time. They were preceded by several pursuits, which also made a record. The bombers made the trip in four hours, while the pursuits beat them in with a time of three hours and thirty-five minutes.

The officers in command were Lieut.-Col. H. H. Arnold, the first man ever to remain in the air over one hour; Major Carl Spatz, of war-time fame; Captain Frank O'D. Hunter, also a war ace, with several medals to his credit; and Major Joseph T. McNarney, past commander, and now in charge of the bombardment group.

Flies Over Indian Battleground

WAITING until he was eighty-seven years old, John Marshick of Cleveland, Ohio, ex-Indian fighter, boarded an airplane for the first time recently when he flew from Cleveland to Los Angeles.

As the eight-ton tri-motored passenger transport flew over western Nebraska and Wyoming, Marshick looked down on the old stamping ground of the Sioux and Cheyennes, where decades ago he and others fought Chief Turkey Leg, who once preyed on the whites in that locality.

Marshick reminisced that the plane in which he flew, traveled as far in a few minutes as the old Indian fighters traveled in an entire day.

Recent Airplane Camera Receives O. K. from Government

J. W. Smith with his airplane camera ready for taking shots.

MR. J. W. SMITH of Philadelphia is shown with his recent invention. It is an airp·ne camera that is a great improvement on most instruments now in use. Chief among its advantages is the light weight, only 24 pounds when ready for action. The camera is made of stainless steel, has a capacity for 75 feet of 10-inch film and has an arrangement for quick changing of the lens, of which it is equipped with several, of various focal lengths.

One of the greatest advantages is the ease with which it is operated. If necessary, the pilot can operate it while controling the plane. It is the lightest and largest camera yet designed to take a picture eight by ten inches.

The air officials of both the army and navy have praised it highly.

Air Express Rates Reduced

THE Railway Express Agency, in cooperation with several national air transport companies, agreed to slash existing air express rates as much as 80 percent. in some cases.

For instance, ten-pound shipments from Chicago to Minneapolis were reduced from $10.00 to $2.40. The New York-Minneapolis rate on ten-pound shipments was $20.00. It is only $6.80 now!

The combination service offered by the Railway Express Agency, and several of the most important airlines, brings the benefit of these new cut rates to 117 cities in the United States. Every Railway Express Agency has become a point at which goods may be forwarded to and from airports.

XUM

Practical Lessons in Flying

by JOHN B. RATHBUN

Bob and Ed discuss the matter of rolls and wingovers, and then experiment

BOB, the flight student, was considerably upset and angry this morning as he hastened out to the field. In this state of mind, he believed that he was being cheated by the flying school and even had grave misgivings as to the knowledge and ability of Ed Keith, his pilot-instructor. If he had been bamboozeled by a lot of incompetents, he was going to settle this thing once and for all, even though he left the school this morning.

Now, all this mental unheaval was the direct result of a confiab that Bob had with another student, Fred Smith, on the evening before. Fred Smith was a student at another school, and was so chesty with his four hours of solo flying that he was willing to tell the world—and Bob—what it was all about. The argument had started on that old threadbare subject. "What is the difference between a roll and a wing-over?" and Bob had come out second best in the controversy. Bob's defeat was largely due to the fact that Smith talked louder and faster than Bob.

Smith was a glib and convincing talker, and in a half hour, had Bob swept completely off his feet in a continuous flow of misinformation. In fact, when Bob had parted from Smith, he felt cheap and crestfallen and as if he knew nothing nor had learned nothing at the school. Hence, he was correspondingly angry with the school and particularly with his old friend, Ed Keith. If Ed didn't know the difference between a roll and a wing-over, then it was just about time to pull up his stakes and hunt out some other school where they did know what they were talking about.

As a matter of fact, this tempermental display was just one more example of the peculiar mental kink that exists in the minds of most students. Why students get this way, no one knows, but the average student will take sides against his instructor in any sort of an argument—no matter how ridiculous the subject and the conduct of the argument may be. In their minds, the instructor is always wrong and everybody else is always correct—even down to the janitor and ground-keeper.

Consequently, when Smith started in sneering at, and belittling the knowledge of the instructor, Ed Keith, he had the instant and complete attention of Bob—who should have known better. Smith with four hours in the air, and a dull student at that, was now the master mind and the oracle. Poor Ed Keith, with his 3,600 air-hours and five years of instructorship, was nothing at all, compared to this prodigy of learning. Smith was right—Ed was wrong.

Bob walked into hangar No. 3, and caught sight of Ed sitting with his feet comfortably cocked up on the bench. Ed, with one quick glance, took in the situation at once and knew that Bob would burst out with some accusation. Like the wise man he was, he kept mum until Bob launched the big offensive.

"Say, Ed," barked Bob, "don't you know the difference between a roll and a wing-over? I got licked good in an argument last night with a guy that knows what he is talking about, and he says that your dope on the roll and the wing-over is all wet. Do you really know what a wing-over is, or don't you?"

"Well," explained Ed, "there's betmen than you and your friend Smith that have got into an argument on this subject. It's just a matter of a hair splitting definition anyway, and nothing to get all cranked up about. As a matter of fact, the old time roll is what the cute little boys now call a 'wing-over'. They just took an old stunt and hung a new name on it. If they can't invent something new, nowadays, they'll take some old stunt and call it by another name, thereby gaining great renown."

"Baloney, don't stall me that way", cried Bob. "There's no use of sidestepping the matter. And say—how did you know that I had an argument with Smith, anyway?"

"In the first place it is no baloney. In the second place, nobody but that mouthy Smith guy would ever start anything like that. He hasn't many air-hours to his credit, but he can certainly talk. You know, he's vice-president of the Fairfield Airport, and its rather getting to be his business to knock this school. If we said that a certain stunt was a roll, he'd right quick say that it was a wing-over on general principles."

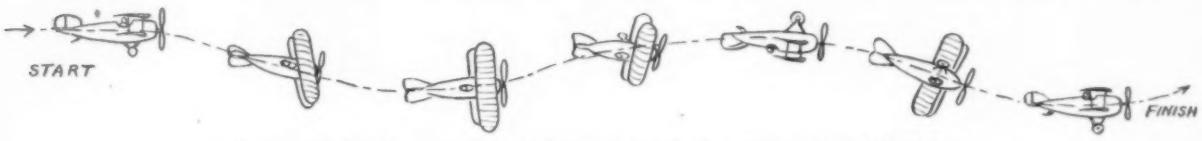


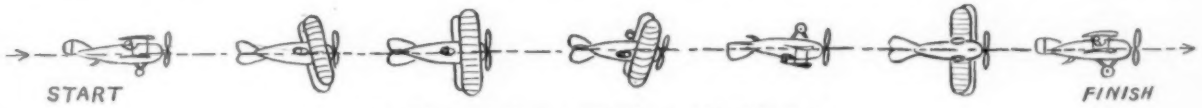
Diagram showing the progressive positions in a barrel roll. Note the helical flight line.

BOB thought this over for a moment and was more than half convinced that Ed was telling the truth about Smith. He had a sudden change of heart and most of his anger was dying out.

"If you want to learn oratory, go on over to Fairport. If you want to learn to fly, stay where you are. Them's my sentiments. But that's not getting down to the question. I'll give you a little demonstration right away, and I hope that it will stick with you this time. It didn't seem to do you much good when we worked it out the other day.

"Now, in the first place, there are a whole lot of different rolls, the half-roll, the barrel roll, the Immelmann roll, the Dutch roll and the aileron roll. The wing-over is something apart from all this. Just why I have to go all over this again is a mystery to me, but anything for peace. Go on, hop over to the ship and we'll start on our way."

Bob and Ed walked over to the ship which was already being warmed up by the ground crew. A few minutes' wait, the ship was ready, and they climbed in, ready for the grand review



An aileron roll along a perfectly straight flight line.

on rolls and wing-overs. They taxied over to the north fence, and then took off against the south wind, climbing as rapidly as the engine would take it. And at 2,000 feet, Ed spoke over the phones. "Hold it."

"Now," said Ed, "we'll start with a nice snappy little half-roll. The big idea is to roll her over on her back, and then roll her right-side-up again while we are traveling along. This is a sudden maneuver so you'd better be prepared for anything.

"Here we start. I kick on full rudder suddenly and pull back on the stick —away we go."

Like a shot, the plane responded and quickly rolled over on her back so that they were in inverted flight. A few seconds in this upside-down position, and then she returned to her normal flight just as quickly. The suddenness of applying the controls gave a correspondingly quick reply.

"The main thing to remember in this stunt," said Ed, "is to put the controls into neutral before she has rolled all the way over on her back. If you delay neutralizing too long, she'll gather enough momentum to keep on going and you'll be back where you started from—pronto. You probably noticed that I left the engine full on.

"Now I will do it again and this time I want you to notice the way that I bring her out of the inverted position. I can do this in two ways. First, by giving her a second half-roll to bring her right-side up. Second, by pulling full back on the stick so that a half loop is formed and then pulling out of this half loop. We'll try the first stunt."

SMACK, went on full rudder and back came the stick, and almost instantly Bob saw the landscape where the landscape is not supposed to be in safe and sane flying. A short pause in this direction and then the controls did the same thing over again so that the other half of the roll was completed. And that's all there was to it except that Bob saw that the controls were neutralized just before the ship was on her back and again just before she was leveled off in her normal flying position.

"And now we come to the good old barrel roll," said Ed, "the old-timer that is sometimes labeled 'wing-over'. This time we go over a complete revolution without stopping while we are flying along a fairly horizontal path. Really it is a nose spin, but in a horizontal path instead of the vertical path commonly known as a spin. (Fig. 1.)

"Now I want to call your attention to one thing. If we snap right around on this roll without interruption, as we should, then the centrifugal force will tend to hold you down in your seat so that there will be no strain on your safety strap. On the other hand, if we just turn deliberately over, or else get stuck with the turn half completed, then you'll sure need your safety just as much as though you were flying inverted. The quicker she snaps over, the greater will be the strain on the seat of your pants and the least will be the strain on the strap.

"Now, unless you're flying a pursuit job with a 500 h.p. engine, it will be just as well to get your speed up with a short dive before you start the roll. And then after this is done, just follow with your controls like this:

1. Apply rudder and stick together, gradually and smoothly in the direction that you intend to roll.
2. When the inner wing drops, pull the stick all the way back, with the rudder full on.
3. Help out by giving as much aileron as possible in the direction of the roll.
4. Before the roll is half completed, reverse the ailerons, but still hold the stick back, with the rudder full on.
5. Just before the roll is completed, neutralize the controls. The ship is now probably near a stall, and recovery should be the same as recovery from a stall.
6. If neutralizing the controls does not bring her to rest, it may be necessary to reverse the rudder and stick to prevent a skid.
7. Engine should be full on during the entire roll.

"Now, can you remember all of that? And don't cut out the engine either, for you're likely to stall anyway—even with the engine on if you don't watch out. The whole idea is to make a complete single revolution without losing any altitude, rolling wing and over wing. Now for it."

ED nosed her down on a slight dive with the engine full on, and then she went over on her turn while Bob caught progressive views of the sky, earth, and then sky again. There was no tendency toward throwing him out of his seat, in fact, the centrifugal force was so great that it would have been rather difficult to stand up with this force acting on him.

"Now, I want to show you why it is not always roses in this business," said Ed. "It was mighty nice going around that way, but if I had not judged the speed right, or if I had stalled her, we would have been out of luck without our safety belts. Now, be sure that your belt is O. K., and I'll give her a slow greasy turn that'll test your belt. Mebbe I'll stall her."

This time, the controls were moved much more slowly, and the wings dipped down and around so deliberately that the centrifugal force was negligible. As a result, Bob felt the harness stiffen at the instant that they were upside down. And then, Ed stalled her part way over on the second turn so as to give Bob a sample of this difficulty. Then followed a steep dive to get her out of the stall and once more they

(*Continued on Page* 258)

A Young Pacific Coast Aviatrix

Miss Equi smiling at the ease with which she won her license.

MISS Mary Equi, of Portland, Ore., has just received her flying license. She is considered the youngest aviatrix in the Pacific Northwest. She was ready for her license two years ago, but the government regulations require a minimum age of 16 years before issuing a license.

A Two-Cycle Job

BEING produced to sell for a popular price of $1,660.00, this plane opens a new market for the aircraft industry. It is a two-place dual-control design and has been built along the lines of a standard airplane. With a twenty-four foot wing spread, a length of nineteen feet, six inches, it weighs 480 pounds empty.

The engine contains many revolutionary features. Using common oil and an ordinary grade of gasoline (the same as used in automobiles), it has been clocked at 4,000 r.p.m., giving the plane a top speed of 100 to 105 miles per hour.

The engine weighs 125 pounds, is a two-cycle super-charged type with battery ignition and a dual battery distributor system.

The generator is built in. There is no crankcase compression and only fourteen rotating parts are employed.

The plane has a landing speed of 30 to 35 m.p.h., and a cruising speed of 80 to 85 m.p.h. It can be taken off in a space of from fifty to seventy-five feet.

A two-cycle lightplane.

New Ideas for Our Model Builders

A Prize Winner

A biplane model with which Art Ramsey won first prize.

HERE is a prize winning model. Art Ramsey, 37 Burton St., Hartford, Conn., sends us this photograph of a model that won the cup in a model meet in his home town.

The prize was offered for appearance and general workmanship. Congratulations, Art.

A Six-Foot Flying Model

WILLIAM WINTER, Jr., Bergenfield, N. J. got very ambitious when he constructed this six foot model of a Condor. Yes, it is a flying model. Some idea of the size may be gotten from the small boy who is holding it.

William Winter, Jr. worked with a friend, Emil Bell. William is only nineteen years old, but he uses model aircraft as a trade. Good luck, Bill!

This model is so large that it is hard to see the boy.

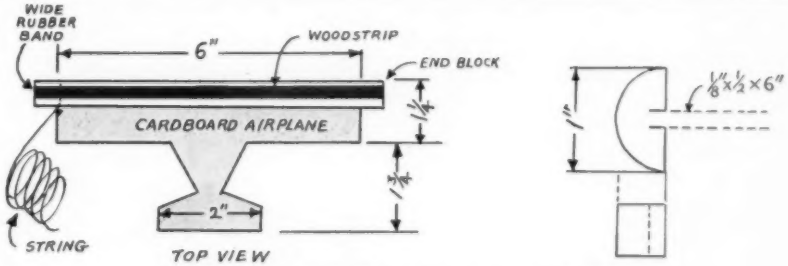
Jack Wally's Keen "Vega" Model

Jack Wally sent this photograph of his Lockheed "Vega" Scale Model.

JACK WALLY, of 801 W. 66th St., Kansas City, Mo., is the maker of this non-flying model of a Lockheed-Vega. It is complete on the inside as well as the outside. The wings, tail surfaces, and fuselage were cut from white pine, the latter being in two pieces and hollowed out by hand. The landing gear and the rest of the equipment was made of brass. All parts were made in his own shop.

This is a very fine model. Looks good enough to fly. Too bad it can't.

Making a Model Sound Like a Real Plane



Complete drawings showing airplane hum attachment.

THE accompanying sketch shows how you can make an interesting little novelty that makes a sound almost exactly like a real airplane engine.

First, cut a piece of thin cardboard to the shape of an airplane. Then glue a strip of about ⅛ in. by ½ in. wood to the leading edge of the wing, and make two semicircular blocks, notched to fit over the ends of the strip.

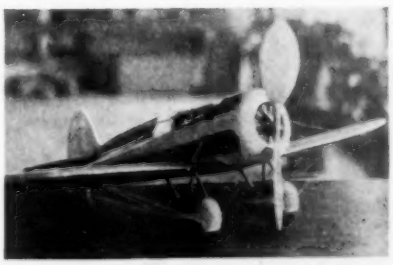
After gluing the blocks in place, stretch a wide rubber band over them and tie a string of the desired length to the point indicated. When the device is whirled around over your head, the air strikes the edges of the rubber band, causing the band to vibrate rapidly.

By using your ingenuity, you might be able to work out a device, operating on the same principle, to be attached to a scale flying model airplane, making its flights even more realistic. A good location for the rubber band in a case like that would be between the landing wheels.

Hawk's "Mystery Ship" Model

WESLEY BROUNE, of Lake Wales, Fla., sends in a picture of one of his recent models. It is Hawk's "Mystery Ship".

The "Mystery Ship" is an exact copy of the original, even to the paint job. Wesley says that the painting was a tough job in itself.



Here is Hawk's Mystery Ship to the very life-color scheme and all.

MODEL DEPARTMENT

How to Build the "Gee-Bee" Super-Sportster

by

JOSEPH S. OTT

THE model illustrated this month is one of the fastest American Sport Racers ever designed for land operation. The body of this model is a little larger in its general proportions than those that have appeared in the past.

The entire motor is cowled, as on the full size plane, to help streamline the entire power plant into the shape of the body. The body is not any shorter than the general average of models, but because of its thickness it appears to be so.

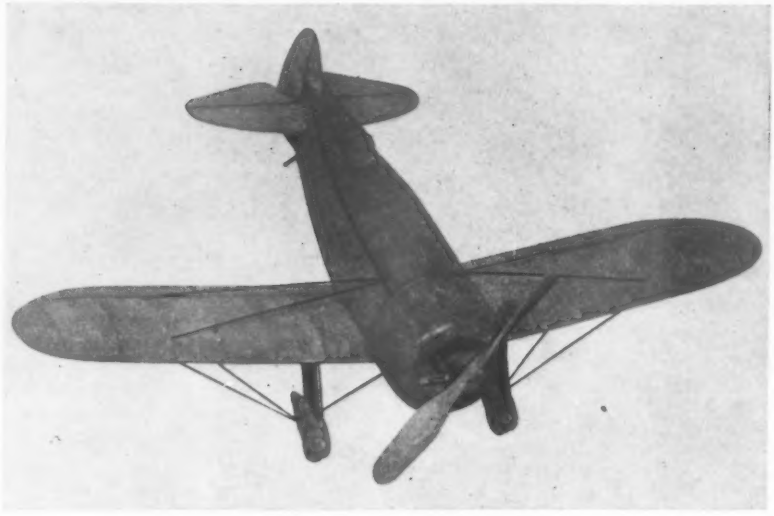
The pilot's seat is towards the rear and the head-rest-fairing streamlines into the rudder. The original model has a large dihedral and this has been employed in this miniature flying model. It helps to stabilize and keep the model on an even keel in flight.

Abbreviated Building Instructions

1. Wing Ribs.
2. Nose Cowl.
3. Body.
4. Landing Gear.
5. Rudder.
6. Stabilizer.
7. Propeller.
8. Motor Stick.
9. Covering.
10. Flying.

List of Materials

1. Bamboo—for landing gear and tail parts.
2. Balsa—10 pieces, ⅛" square by 30" long.
3. Fairing Strips—5x$\frac{1}{16}$x$\frac{3}{32}$".
4. Wheels—1⅜" for 15" model or 2" for 30" model.
5. Rib Stock—$\frac{1}{16}$x2", ½x30". Firm wood is recommended. For 12" and 24" models use $\frac{1}{32}$" thick material.
6. Fittings—all made of tinned piano wire, .029".
7. Motor Stick — $\frac{3}{16}$x$\frac{5}{16}$" Pine.
8. Propeller—in proportion to the size of model. The 15" model uses 6" diameter, 24" model 8" and 30" model uses a 10" diameter prop.
9. Motor Rubber — 30 gauge by ⅛".
10. Spars—$\frac{1}{16}$x$\frac{3}{16}$" for the 24" model.



A view of the completed "Gee-Bee" model.

11. Trailing Edge—$\frac{1}{16}$x¼".
12. Entering Edge—⅛x⅛".
13. Tissue—Hakone.
14. Cement—½ ounce.
15. Dope—1 ounce.

Wing Ribs—No. 1

Because of the long sweep and curve to the rear of the wing, the ribs become shorter as we approach the tip. The depth of the ribs is the same throughout, although on the large plane there is a taper and each rib is a little shorter and thinner as we approach the tip. It is easy enough to follow this method in model if desired.

After building the left and right sections, they may be assembled and cemented together with a small offset at the middle of the body, which is later set in and cemented in place.

Nose Cowl—No. 2

The drawing illustrates a nose made of solid balsa, cut out on the inside to a taper, bringing the bulk of the weight to the very front of the model. The cowl may also be built up of sections employing balsa ribs or formers to the shape indicated by the solid nose. A ring must be employed at the front and rear of the formers and the paper covering is then put on in sections.

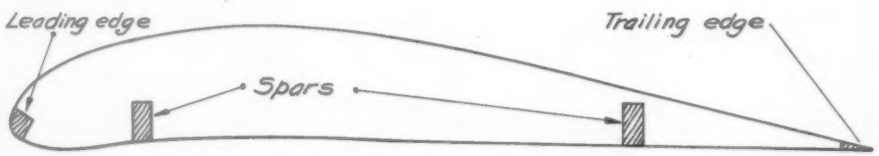
Body—No. 3

A full size drawing of the body, beginning at the rear of the cowl and to the rudder post, should be drawn up. The top view and a side view are necessary. The longerons are placed in position and the uprights are cemented on. When the left and right side has been completed, assemble them as illustrated in the top or plan view.

The nose cowling may be added at this time so that the general arrangement and sizes of the body formers may be put on correctly. The shape of these formers will vary as work progresses toward the rear and it is best to cement them all in at once and then sand down to the correct height on the sides, bottom and top. To the rear of the cock-pit, the fairing is a little

(*Continued from page* 252)

Rib for 15" Model full scale.

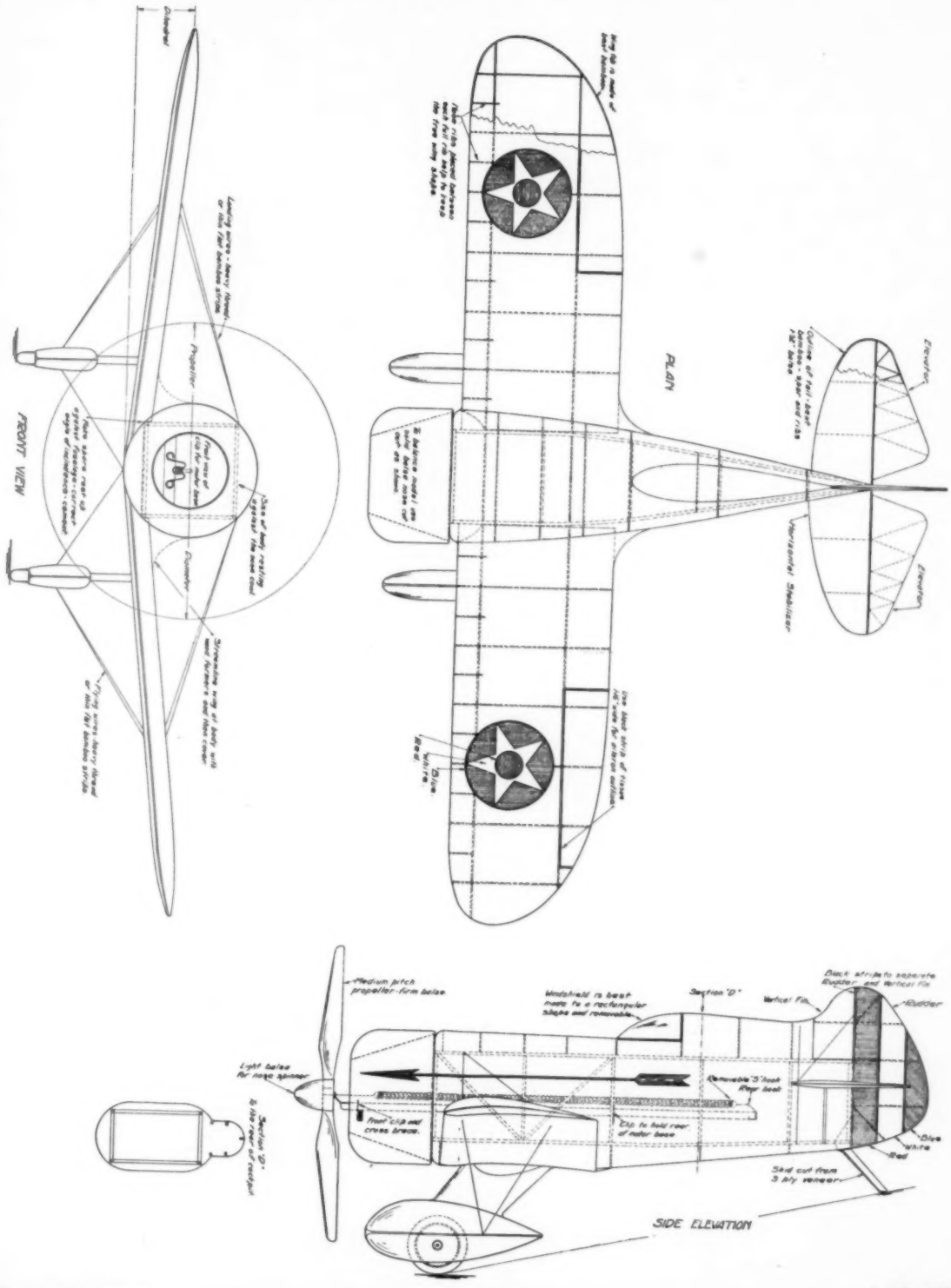


Rib for 30" Model full scale.

Full size rib drawings from which the wing section curve can be traced.

The "Gee-Bee" Supersportster Monoplane

A Flying Scale Model

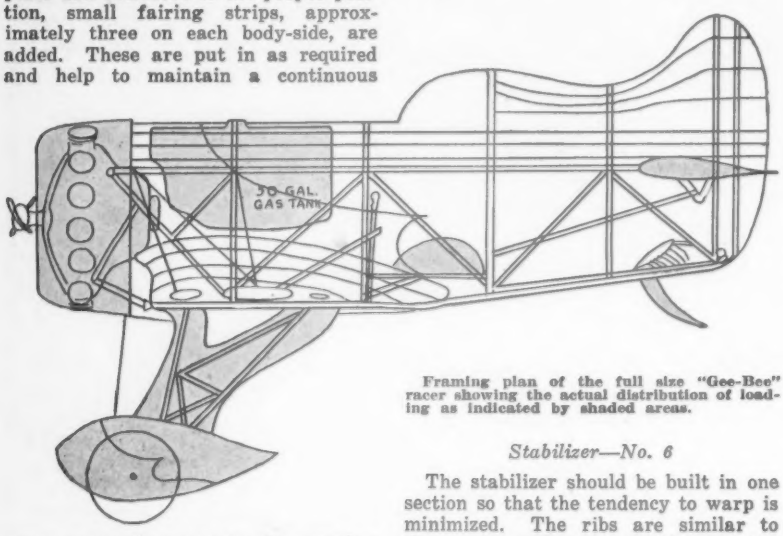


Model Department

(*Continued from page* 250)

taller than the rest as this part is intended to streamline in the cock-pit section.

After the formers have been put in place and cemented to the proper position, small fairing strips, approximately three on each body-side, are added. These are put in as required and help to maintain a continuous curve, preventing sags in the covering over the entire body structure.



Framing plan of the full size "Gee-Bee" racer showing the actual distribution of loading as indicated by shaded areas.

Landing Gear—No. 4

The landing gear and wheel pants may be built up entirely of balsa, or a celluloid manufactured type used instead. The landing gear cements to the first full rib out to the body and is held rigidly from swaying from side to side by the flying wires. These are added only after the model has been completely covered. Small bamboo strips, thinned down considerably, make ideal flying wires.

Rudder—No. 5

The body, having been completed, it is ready to receive the rudder which is a continuation and completes the streamlining to the rear. The rudder post should continue to the top part of the bamboo outline. It is bent by a Bunson burner or candle flame and formed by the fingers to the correct shape. The ribs used in the rudder are streamlined and curved on both sides equally.

Stabilizer—No. 6

The stabilizer should be built in one section so that the tendency to warp is minimized. The ribs are similar to those employed on the rudder and the proper position on the body is illustrated in the side elevation.

After the rudder and stabilizer have been completely covered, a small black strip of tissue paper should be cemented in position to improve the appearance and to offset the stabilizer and the elevators. The rudder is carried out in the same manner.

Propeller—No. 7

The propeller should be medium pitched and have a clearance of approximately one inch above the floor level when the model is in flying position. The nose spinner may be added, but is not necessary.

Motor Stick—No. 8

The side elevation clearly illustrates how far back the motor stick extends and also shows the arrangement of the fittings and thrust bearing in their proper positions.

A point of caution when making the propeller shaft. Bear in mind that the length is very necessary and decreases the possibility of the propeller wobbling. When the propeller shaft is only one inch long, and the rubber is knotted, it causes the propeller to wobble around, thereby decreasing the thrust.

If this same shaft is increased ½ inch, all wobble will be eliminated. Possibly a slight sacrifice of rubber length might result, but the total length may be increased to compensate.

Covering—No. 9

The entire model should be covered with Super-Fine or Hakone tissue. The top cowling of the fuselage should be in red. The sides, from longeron to longeron is white with the lower part in red. The wing and tail are entirely white with lines in black for ailerons and controls.

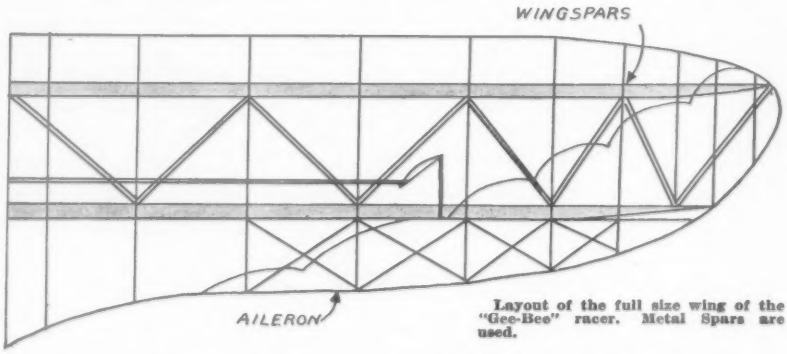
A small black strip may also be run across the wing near the fuselage on the first rib. The nose cowling should be aluminum. If built up in sections, between each bulk-head may be red and white stripes around the entire nose.

The arrow may be red or black. The skirt should be painted black, including the landing gear struts and wheels. The wheel pants should be red or white. Decorations, illustrated by stars and tail stripes, are not necessary but help considerably to put the finishing touches on the model.

Flying—No. 10

A little difficulty might be encountered in balancing this type model, but when studying the side elevation, take note that the nose, the motor-stick and wheel pants, are either to the front or half way in respect to the center of pressure. The center of pressure should be about half way to the rear from the leading edge. If the model is tail heavy it will be necessary to add a small weight to the nose of the ship.

It is interesting to compare the loading of the model with that of the full size machine. In the full size machine the engine, fuel tank, etc., are concentrated around the center of pressure, while in the model, the motor load is distributed.



Layout of the full size wing of the "Gee-Bee" racer. Metal Spars are used.

Use this handy coupon for

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WOMEN'S ACTIVITIES
Edited by Lady Mary Heath

A branch of the Women's International Association of Aeronautics was established in Mexico by Mrs. S. Mary Williams (Lady Heath), president of the organization, on January 7. A meeting was held at the Imperial Hotel, Mexico City, with 10 well known Mexican and American women present.

Lady Mary Heath.

The wife of the president, Her Excellency, Senora Ortez Rubio, is patron; Senora Escarette, wife of General Escarette, was elected president. Vice presidents include Senora Robinson and Senorita Calles, daughter of the former president of Mexico.

A number of American women living in Mexico City are among the membership, including Mrs. C. Clevenger, wife of the well-known American pilot, Mrs. Boynton, Mrs. Wright and Mrs. Wightman.

Mexican women who are members include Senora Acosta, wife of General Acosta, Senora Gomez Valasco, wife of the general in command of the Mexican police officers. Both Senora Acosta and Senora Valasco are on the entertainment committee.

The Mexico City group also includes a number of "companeros", including General Roja, in charge of all civil aviation, General Fiero, Colonel Leon, a well-known Mexican pilot, General Salinas, Senor Bacardi, General Escarette, Mr. Bullock, Mr. Fletcher and Mr. Clevenger.

Lady Heath has been flying a plane belonging to the Mexican air force while visiting in Mexico City, which was placed at her disposal by the wife of President Rubio. She is the only woman who has ever been allowed to fly a Mexican army plane.

* * *

Lady Abe Bailey, the well-known British flier, passed her examination for her blind flying license at Southampton recently. Lady Bailey is well known for her flight from London to Cape Town and return.

* * *

Amelia Earhart Putnam was one of the speakers at the first dinner of the Society of Women Geographers held in New York in February, at the Daniel Giraud Elliott Hall of the American Museum of Natural History.

Miss Earhart said in her talk that she merely "buzzed around" and received credit usually for things she had never done, such as swimming the English Channel and "being picked up by those lovely Azores". She predicted great strides in aviation in the next two years.

Miss Ruth Nichols recently flew a Diesel-powered Lockheed plane to a new altitude. She bettered the record made by Clarence Chamberlin, flying the same plane.

* * *

Mrs. Subbaraya, who was one of the two women delegates to the India Round-Table conference in London, flew home to Bombay by way of the Karachi air mail from London.

* * *

Mrs. Cleaver, who started on a flying trip from London to Morocco, was held up so long at Lyons by bad weather, that she abandoned the trip and returned to London.

* * *

Miss Shamrock Trench, who recently obtained her "A" license after a course at the Irish Aero Club, is the first Irish woman to obtain a pilot's license. She is continuing her work and plans to obtain a "B" license.

* * *

The Hanworth Flying Club of Hanworth, England, gave an airplane party recently designed to interest children in flying. Children who were guests at the party were treated to flights.

* * *

Licensed women pilots in the United States on January 1 numbered 532, classified as follows: Transport, 42; limited commercial, 56; industrial, 1, and private, 433. The 9,016 mechanics in the country included five women. There were also 14 women glider pilots.

British women outnumber men as aviators, probably because the women of England have gone into flying as a sport, was a recent comment of Charles S. Jones, vice president of the Curtiss-Wright Corporation. In Great Britain there are 3,349 women with pilot's certificates.

"In England, and elsewhere in the British Isles, aviation has attracted a large following simply as a sport or diversion," said Mr. Jones. "The Government there sponsors and aids flying clubs, while here the person who flies for fun gets no subsidy. There are no great distances between cities there, and as a consequence ships which will cruise along at 60 or 65 miles an hour are fast enough. But here aviation is confronted with the job of providing transportation that is much faster than other methods of going places.

"In America the number of men interested in commercial aviation is so large that simply by comparison it appears that the number of women engaged in it is small."

* * *

Mrs. Dwight Hartman, who has been active in aeronautics in Seattle, is using her seaplane to go fishing. Mrs. Hartman loads her plane up with tackle and flies out to lakes not ordinarily reached by fishermen, and makes good catches in virgin waters. She fishes standing on her floats.

* * *

Juanita Burns, of Los Angeles, is doing work in instrument flying instruction with the Mercury Flying Club at the United Airport, Burbank, California. Miss Burns plans a non-stop Tokyo-Seattle flight in April.

* * *

A number of airwomen have been married during the winter. Probably the best known of the group being Miss Maude Irving Tait of Springfield, who married James P. Moriarity and has been honeymooning in the Caribbean. Miss Tait has made a reputation in high speed plane racing and has missed the women's speed record by a bare fraction. She won the Aerol Trophy at the National Air Races last fall.

Alicia Patterson was married to Joseph W. Brooks, the well-known All-American football star. Mr. Brooks is an investment broker, but has also taken his transport license. Mr. and Mrs. Brooks enjoyed an aerial honeymoon.

Miss Anna Ward, the first New Jersey woman to take a pilot's license, has announced her engagement to DeWitt V. B. Thomas of Morristown, N. J.

* * *

Miss Marjorie Worthington, a novelist, is accompanying William Seabrook, British explorer and author of "The Magic Island," on a plane trip.

END

Q & A

(*Continued from page 239*)

is a reverse rudder? (3) *What is the principle object of a slide-slip?* (4) *How is a loop executed?* (5) *What is an outside loop?* (6) *Why is it so difficult?* (7) *Why is spinning a very necessary evolution to learn?* (8) *What is the "falling leaf"?* (9) *What is the main object of an Immelman turn?* (10) *What is the cart wheel?*

ANSWER:—ABILITY to stunt fly, aids in getting out of trouble. So called "tricks" are very valuable, and their knowledge adds to the pilot's confidence. (2) A reverse rudder is one turned against the direction of a spin. (3) A slide slip is a means of losing altitude with a minimum of forward motion. (4) An inside loop is made by pulling back on the stick, keeping the other controls held neutral. (5) The outside loop is begun with a dive, the inside loop is begun with a zoom. (6) The centripital force tends to throw the pilot out of his seat, and upsets his sense of equilibrium. (7) Spinning is not necessary to learn, it is necessary to learn to get out of a spin. (8) A falling leaf is a series of zooms and dives, the altitude of the top of each zoom is lower than the previous one. (9) It is chiefly used to reverse direction without banking. (10) The editorial staff has never heard of a "cart wheel" in regards to aviation.

END

XUM

Dicky Phelan

(*Continued from page 216*)

shoot down the German, Dicky had somehow caused the fire in his own plane to go out.

But read his own succinct report: "I went down on a Fokker, and had another on my tail who riddled my ship with his gunfire. He succeeded in setting my tanks aflame—this while I was 3,000 meters up. There seemed to be little choice between staying up or going down. As I figured everything was over, I decided to make the best of my time. In diving and side-slipping I managed by a lucky chance to get on the tail of one of the two Fokkers and shot him down. His companion wasted no time in getting away.

"The surprise of surprises was that the fire suddenly ceased, for while making the sudden maneuvers, the flames went out. However, during the time my plane was so badly damaged that I had to land where I could. I came down in the conglomeration of trenches, barbed wire and shell holes north of Verdun. After that it was simply a matter of transportation."

Dicky received confirmation and credit for the Fokker he destroyed in this combat. It is too bad that his terribly damaged Spad was not preserved for an interesting museum piece.

Dicky's last combat took place several days later. In the bitter, oppressive reaches of the upper air he and his comrades joined battle with the Germans again. It was a grim, deadly affair, with the German planes outnumbering our own. Before the fight was thirty seconds old one of the Americans climbed his Spad steeply, hung on the propeller and riddled the belly of a Fokker.

Slipping off on a wing, the hostile plane hurtled earthward to end in a grinding crash far below.

At practically the same moment three of the enemy overwhelmed an American pilot and drove him to the ground. He was wounded in several places and his Spad badly shot up.

Dicky had his encounter with a single plane. He was seen to make a *chandelle* and then half roll on the German's tail. Some time later a second Fokker cut across on him—a disastrous accident that was likely to happen to the best of pilots in a dog-fight. But it put Dick Phelan out of the Big Fight.

In the short time that Dicky lived and fought he earned the reputation of being one of the most fearless fighters we had on the front.

END

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Turbines

(*Continued from page 236*)

number of years. This shows that the gas turbines are leaving the laboratories and embarking upon the actual service to industries.

The practical data obtained from the operation of these turbines is available for guidance in the construction of other units. These large machines are undoubtedly the forerunners of the gas turbines, which will find their use in the near future in the air, land and sea.

IT IS well known, that the aircraft motor of to-day is a wonderful piece of machinery. But it is not a reliable and robust mechanism on which the future of aviation can safely depend. The motor is the weakest point in the whole structure of airplanes. It will continue to be so until something new and radically different from the reciprocating engine will be developed. The reciprocating principle involves such a multiplicity of parts, which of necessity are stressed to the limit in order to obtain a light construction, that it is hardly possible to expect that a simple and reliable mechanism will ever evolve from it. These parts—hundreds of them—are continuously hammering and pounding on each other, producing changes in the micro-structure of the metal, which eventually lead to failure.

It could be stated without exaggeration that the present type engine is holding up the aviation field for the sole reason that so far no substitute for it has been devised yet.

On account of its inherent characteristics, this type of prime mover is not readily affected by the drop in air pressure, which makes the gas turbine eminently suitable for very high altitude flying, in a region where all long distance flights in the future probably will be performed. On the other hand the ordinary motor, especially when equipped with a super-charger, serves only as a compromise. It is

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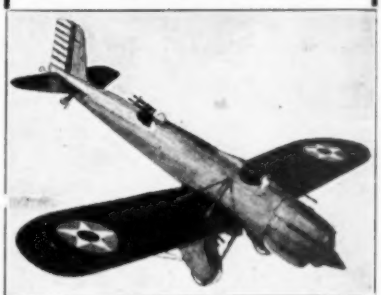

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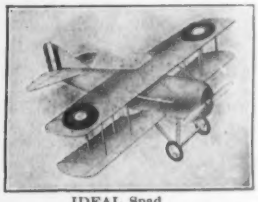

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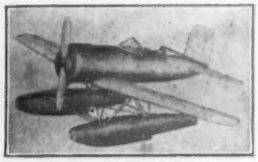

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known from actual tests that, in a supercharged motor, more than 50 per cent of the energy, developed by the combustion is wasted away into the exhaust. The better solution of the problem therefor seems to be to have two separate motors on each aeroplane, one for low flying and the other for flying at some predetermined altitude.

The safety of the reciprocating engine is still further aggravated by the large amount of mechanical friction within and all-importance of a perfect functioning of a lubrication system. The turbine has no reciprocating parts and practically no mechanical friction, as it could be equipped with ball bearings. There is nothing in the turbine, that is likely to break. The number of moving parts is virtually one, i. e., its rotor. This condition, together with the elimination of a lubrication problem, affords the opportunity to make the motor which is a fool-proof.

To the drawbacks of the present engine also should be added vibration, noise, hard starting, and difficulties in mounting. The life of an internal combustion engine is extremely short, and in addition it requires frequent overhauling and readjustments. The turbine, however, affords a smooth operation, easy starting, due to the absence of compression cylinders, and ease of attachment to the framework of an airplane. It has almost unlimited life, due to the absence of wear, save a few removable parts, subjected to the action of high temperature gases.

The turbine, designed to fulfill all these expectations, is shown on the accompanying drawing. This turbine is designed for the output of 250 h. p. It has an outside diameter of only 24 inches, which indicates the compactness of a mechanism and a negligible head resistance. Its beautifully streamlined shape seems to fit the aeroplane admirably. Its simplicity permits of such an arrangement of parts, that it could be taken to pieces for inspection within half an hour.

An experimental model has been built and operated successfully, leaving no doubt that a new type of aircraft motor was produced with big potential possibilities. On the ground of the test data, obtained from the operation of this first experimental model, the plans are advanced to construct a 250 h. p. motor, shown in the illustration and details are developed to permit it to operate on heavy fuel oil instead of gasoline.

The idea of gasoline turbines is not exactly new. Several times in the past, there have been various attempts to solve the problem. Each one, so far, has resulted in failure. Some of these failures have been the result of poor design, while others were due to improper metals and other materials.

It has been definitely proven that some of the recently developed alloys solve the troubles problem of suitable metals.

END

E. L. Cord

(*Continued from page* 218)

their demand for a living wage, then it will not be long before rate-cutting wars will correspondingly reduce salaries on the other air lines. And when this takes place, the better class of pilots will undoubtedly look to other fields for a livelihood.

The standards of ability and training for air pilots will be lowered commensurate with the reduced wage scale, and an entirely new type of pilot will be found entering the field. Frankly, a new type of pilot which will scare us from even living near an airport.

This is not merely a fight between your pilots and yourself, Mr. Cord, but it is a fight between you and all of the other air line pilots in the United States, both organized and unorganized. Your pilots have kept faith with you: they have acted like gentlemen while under stress, as becomes high grade men, neither resorting to vandalism nor hoodlumism. Yet they are not accorded the courtesy of arbitration nor of any other fair means of adjustment. Can you afford to be less fair, less gentlemanly than the men you employ?

It is evident, that when the Century Air Lines arbitrarily arrived at a monthly wage of $150.00, plus a few problematical extras, that they overlooked the many financial burdens and limitations imposed upon the air line pilot. In the first place, as we have already remarked, the pilot must invest from $5,000.00 to $7,500.00 for his training to obtain a full transport license from the Department of Commerce. And during most of this training period, he is without any source of income.

Second, the wage earning period of his life is quite short. He must make enough money to last through his lifetime within ten years, for in ten years he is generally "burned out" and through, so far as piloting is concerned. Do you believe, Mr. Cord, that a man can save enough money in ten years with a salary of $1,800.00 per year to last him for the remainder of his lifetime? We do not believe this, and we are sure that upon reflection that you do not believe it any more than we do.

Have you forgotten your own position as a paid employe, Mr. Cord? Not so many years ago, as an automobile salesman, did you not feel the need for a sympathetic understanding of your problems by your employers, and did you not then resent any overbearing, high handed attitude by your employers?

Even now as head of Century Air Lines, you have your share of battles against superior power and influence. In particular, we refer to your battle to obtain a share of the air mail contracts.

Despite your offer to the government to carry mail at a lower rate than the other lines, your bid is apparently ig-

XUM

nored in favor of those operators whose range of influence in Washington is stronger than yours. In this air mail fight, you are on the right side, and POPULAR AVIATION stands ready to give you real support. As a matter of fact, we have an investigator in Washington right now, digging up the real facts on who controls the air mail contracts, for publication in an early issue.

But in your fight against the Century Air Line pilots you are in the wrong. POPULAR AVIATION urges you to reconsider your action in the light of fair dealing and public service. POPULAR AVIATION in no manner attempts to suggest what wage scale should be adopted for your pilots—that is a matter of arbitration and action by either you or your pilots, not a matter of a strike or a lockout.

A dozen able unbiased mediators stand ready to service you and your employes in this controversy. The pilots themselves are willing to submit the matter to arbitration. Are you?

END.

Rotor Ship

(*Continued from page* 245)

plate come into its greatest use.

It is possible to reach a cruising speed of up to 70 miles an hour with a 40 horsepower engine, using the rotor propulsion. A speed boat has already been built which has an efficiency of 80 per cent. This boat is ready for launching this spring.

There is no reason why a 200 horsepower airplane engine could not produce a speed of more than 500 miles an hour with this new development.

The idea of the rotor is along the same lines as the rocket ship. The rocket ship is forced ahead by successive blasts of chemicals which have intense pressure against the air. But the question of fuel supply is an important one. The rotor ship is driven by the conventional gasoline engine. The rotors agitate the air placing a great pressure of air against the normal pressure.

A feature of the rotor is, that it has equal intake and exhaust pressure. The center of pressure is along the path of the axle. Double rotors are projected for the airplane to secure volume of air being placed in motion.

The "feel" of riding in a rotor ship will be a great deal different than the present day craft. There will be no blast of wind from the propeller because there will be no blades in front of the cockpit. The only air motion will be from the forward motion of the plane.

America

(*Continued from page* 215)

ahead of anything in the world, if it were organized properly, the overhead cut out and a definite policy and unified system adopted."

No one who has investigated the present status of military aviation can doubt the accuracy of General Mitchell's diagnosis. Our air program is being strangled by red tape—and the red tape is being manipulated by its enemies. Creation of a new Department of National Defense, in which the Air Service will be on an equal footing with, and entirely independent of the Army and Navy, is the first step—and the most essential step.

BUT even when this is accomplished, much will remain to be done before we have a national air service worthy of the name. For one thing, we must sweep the lobbyists off Capitol Hill and put an end to the rank favoritism which is now disrupting the aviation industry. Unfortunately, commercial aviation in the United States is still in a stage where our manufacturers rely upon military purchases for approximately 70 per cent of their annual output.

The future of aviation, as an arm of defense, depends to a great degree upon the condition of the entire industry, and certainly the industry as a whole cannot flourish so long as a few favored firms are given most of the fat contracts.

Entirely too much of this partiality—to call it nothing worse—has been displayed by the "brass hats" at Washington. Too many highly placed Navy and Army officers resign—and later bob up as directors and officials of concerns which seem to get the juiciest construction contracts.

Too many men who have "inside" political connections are acting as "legislative representatives" in Washington. Too many campaign contributors are becoming the beneficiaries of air mail subsidies—and these subsidies cost the taxpayers some $37,000,000 annually.

Far too many relatives and friends of cabinet officers, or men high in administration circles, are appearing in the picture to make it a pleasing one.

Already, after a comparatively brief investigation on behalf of POPULAR AVIATION, I have come across certain facts which show the existence in Washington of an aviation lobby of special privilege seekers who will completely disrupt the industry unless their depredations are checked. Also, I have unearthed concrete and definite evidence concerning air mail contracts which reveal conditions which are not only sensational but utterly scandalous. I shall treat these matters in detail in ensuing numbers of POPULAR AVIATION.

END.

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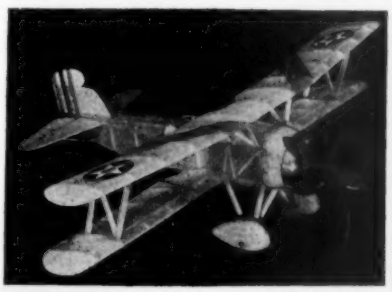

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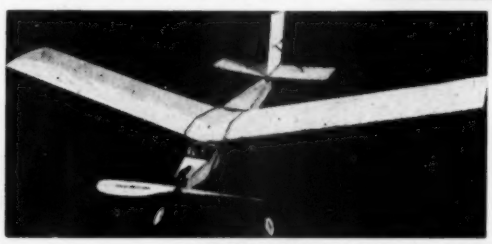

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Forest Fires

(*Continued from page* 236)

be maintained between the pilot and the fire warden who is directing the fighting. The pilot, having a greater range of vision, will be able to radio valuable information about the fire to those on the ground. Warnings will be radioed to the men when bombs are dropped.

The combination of the bombs and the radio, to say nothing of the speed with which the plane can get from one place to another, will be a great aid in forest-fire fighting. It must not be supposed that the planes will be able to put out a fire without the use of men on the ground. The planes will be able to shorten the time necessary to put out the fire and will eliminate a great deal of danger. The time saved will mean valuable timber saved, representing a great saving in money.

It is not uncommon for fires to burn for weeks, and to need a thousand or more men to fight them. The airplanes will reduce that time to a few days or hours. The bombs will do the work of many men.

Fire-fighting experts and lumbermen have estimated that in one year the planes will earn their cost and upkeep by the valuable forests that are saved. They welcome this new addition to fire-fighting equipment as the greatest aid, designed in many years.

This is not the first time airplanes have been used by the forest rangers. For several years they have been used for patrol duty. This is the first time they have been used for actual fighting. The pilots, in addition to being experienced in the air, are seasoned forest-fire-fighters.

END.

Helicostats

(*Continued from page* 222)

headlines as a Spanish wonder, more than 12 years ago.

Rising and landing vertically, able to stop without losing altitude and even to back up, the helicostat flies fifty miles an hour and is controllable at any speed. It is the first practical application of the static-dynamic lift combination. It seems to have interesting potentialities.

The newcomer is composed of a cigar shaped balloon of about 5,000 cu. ft. capacity and is of the semi-rigid type. Built on the stern of the bag are vertical and horizontal fins on which are hinged elevators and rudders. Rigidly suspended from the keel is the control room and engine mounting where a 9 cylinder radial, 40 h. p. Salmson engine is delivering power to drive. The following are the essential elements—

(1) The lifting propellers (for vertical motion).

(2) The driving propellers (for forward motion).

(3) The steering propeller.

These propellers not only have a variable pitch, but are also fully reversible in flight, which permits—

(a) To check forward motion by reversing, as in marine work.

(b) To check involuntary ascent (from gust of wind), by reversing the lifting propellers.

(c) To steer the ship at slow speed when there isn't enough steerageway to use the rudders.

Constant pressure is maintained in the envelope by the expansion or contraction of an inner balloon supplied with air by a compressor driven off the main engine. The machine is heavier than air by some 450 lbs. This, the tiny radial must lift, besides dragging the bag 50 miles an hour forward.

Clumsy, cumbersome and experimental as it is, the Oemichen hybrid contains interesting potentialities. Suppose somebody rigs up a cigar shaped balloon (of about 1.5 times the capacity of the hopper bags) above the fuselage of an aviette, and instead of using wings, builds autogiro-like windmills driven from the main cranks.

There is little doubt these could easily take care of the 75 or so pounds excess of weight over the air, and that the forward motion could be obtained through the nose propeller without unduly drawing on the engine.

As a sporting proposition, such an aircraft would be even more practical than the glider because it is strictly independent of the weather and the "terrain". It would be able to return to its starting point under its own power, doing away with a lot of troublesome ground handling. In the hills and mountains, it would become possible to jump the chasms and fly up and down the canyons—at least in calm air.

Of course, there are shadows in the picture. The gas is always an expensive and cumbersome thing to deal with, but, with cotton prices way down, it ought to be possible to market a cheap rugged bag of sufficient capacity for inflation of coal and possibly methane gas.

END.

Practical Lessons

(*Continued from page* 248)

were flying level with a comparatively small loss of altitude.

"And now we will tackle the aileron turn," said Ed, "a complete turn-over around the body with the ship still flying along a horizontal path. So far as the position of the ship is concerned, this is about the same thing as the barrel roll. The difference lies in the fact, that the ailerons are the principal controls in the aileron turn. Now just listen to these operations and you will learn how the stunt is done:

1. With nose on the horizon, push the stick all the way over toward the side in which the roll is desired. This gives an aileron movement that turns her over.
2. When the wings are vertical, give a little top rudder to hold the nose up to the horizontal.
3. When on her back, neutralize the rudder.
4. When the wings are vertical on the other side, apply opposite rudder to hold the nose up.
5. The elevator flippers are held in neutral all of the time while the stick is held to one side to apply the ailerons to the controls.
6. The engine is full on all the time.

"Now, we'll go after this stunt which I think you will find smoother than the barrel roll, although it is usually somewhat slower with the ailerons proportioned as they are on most ships. And, further, notice that the only control that I jiggle is the rudder, mainly to keep the nose up and to hold the horizontal path."

Over she went very smoothly and without perceptable deviation from the flight path. This seemed easy, so that Bob signalled to take over the controls for his own trial. The first half the roll was easy, but in the excitement, Bob put reverse rudder on her at the moment that the wings were vertical, down went the nose and then the prospects of a good struggle were imminent.

Ed sat silent, however, and let Bob battle it out by himself, for they still had plenty of altitude. Bob remembered the old axiom, however, "when in doubt put her into a dive", and so doing, managed to get her out of a half spin, although he did not complete the roll. Two more trials were required until Ed signalled that they had enough practice on this stunt and again took over the controls.

"WELL, just to show you that my heart is still in the right place, I'll give you a sample of a wing-over and see if you can distinguish it from the rolls. In short, this is a wing-over turn which is frequently confused—by name at least—with the barrel roll. Here she goes."

Down they went in a steep dive, and then up into an equally steep zoom, Ed starting to bank her up on one wing as they approached the top of the zoom. At the same time the turn was started, so when the top of the zoom was reached, the turn and bank was a maximum. The nose dropped into a dive at the top of the turn, and from this dive, the ship was pulled out into the level. It more or less resembled an Immelmann turn—but slower.

"Now, if I continued the bank until she was clear over," said Ed, "we would have a true wing-over—although this is not commonly known by this name. There's been a whole lot of definitions to cover the wing-over, and as most of them include the definition of a roll as well, I'll stick to my definition and continue to call them rolls, half rolls, barrel rolls or aileron rolls. Time to go to lunch."

END.

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Crashes

(*Continued from page* 222)

hot-water bottles, hot bricks or heated stones, being careful not to burn the person. If he can swallow give him strong coffee, hot milk or hot water, or a half teaspoonful of aromatic spirits of ammonia in water. *Never pour liquid down the throat of an unconscious person.*"

At all well-equipped airports we see first-aid kits in hangars and administration buildings. In common with some of my readers perhaps, I wonder just how many employees at airports are familiar with the above authentic first-aid instructions? They should be, for practically all standard kits carry simple and complete instructions.

So much for the victims—now what of the wreckage? Since we're assuming there has been a major crash—a complete wash-out—there isn't much value attached to what's left. Nevertheless you *are* guilty of committing a theft if you remove the twisted propeller or a detached cylinder to carry away as a souvenir, for the former owner is still the owner.

It's a mistake to assume that an airplane becomes public property, once it ceases to be an airplane, if you get what I mean.

AND, in case this dissertation on property rights doesn't thrill you, I might mention that the Aeronautics Branch of the Department of Commerce are still very much interested in the wreck, for what they are after are the *facts* concerning the cause of the accident. Especially, if it may have been attributable to "structural failure of an airplane."

The most complete way of frustrating the investigation of the Inspector is for someone to carelessly toss a match or cigarette on the gasoline-soaked ground around the wreckage! And mark you, this has been done while the victims were still pinned in the wreckage!

However, in a recent crash of an Army pursuit plane in Maryland that subsequently took fire, it was assumed that someone had carelessly allowed a butt or match to burn the wreck, but investigation showed that a shorted battery in the P-12 had probably set the gas fumes off after smoldering away for an hour or so.

In mentioning Army airplanes, it might be well to point out that the Army, Navy, Marines and Coast Guard investigators are as interested in investigating crashes of their aircraft as are the Department of Commerce Inspectors in looking up commercial aircraft mishaps.

Upon arriving at the scene, the investigator looks over the wreckage thoroughly. He questions eye-witnesses. Don't annoy him by hearsay or opinion evidence. All he will be interested is obtaining the dope from the eye-witness or one who actually *saw* the mishap. So far, and unless new legislation has gone through during the publication of this article, your testimony and the findings of the inspector will be treated as confidential. If you saw anything, tell what you actually saw.

REMEMBER, that the Department of Commerce, the Army and Navy, are all carrying on these investigations with a view to decreasing accidents of a similar nature or resulting from a like cause. Like the good physician, these investigators are out to work themselves out of a job.

And now, how about the newspapermen, the reporters and photographers? Well, brother, I don't like the cameramen any more than you do, but you're only hurting yourself to indulge in a camera-busting row when they snap pictures of some wreck in which a friend of yours may have come to grief or of a crashed plane belonging to your company. An attempt to obstruct them only gains some nasty, usually untrue, editorial comment from the newspapers for which they work.

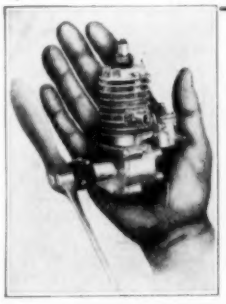
Probably the best policy is the one I have noticed followed at an Army post. As soon as the pilot and passenger were removed from the wreckage, the officer-of-the-day saw that every photoman *got* his shots while the Operations Officer typed out the facts in the case, with names and home towns of the injured and other data for the reporters.

Two, of the five papers in town, did not print the pictures, none of them gave scare-heads to the story and no captions nor write-ups were unfavorable to the Army Air Corps. One paper, in its Sunday edition, praised the Army and Navy for the good work they were doing to eliminate such accidents as the one in question.

That is what one calls Good-Will. It wasn't obtained by acting secretive, high-hat or nasty.

While flying goes on, the Crash-Siren may sing its song at any time. Let's hope they all rust up from disuse. But if one sounds when you are near, the above dope is there for you to follow.

END.



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Exam for Mechanics

(*Continued from page 223*)

structure, excluding fittings?

Is it necessary to carry the log book in a licensed airplane when making cross-country trips?

Are electric landing lights required on licensed airplanes used only in transportation of mail at night?

What is meant by a periodic inspection?

When is a periodic inspection made?

Is an applicant for mechanic's license required to pass a practical as well as a theoretical examination?

AIRPLANE ENGINES

How is the oil pressure regulated on an aviation engine? Name the engine.

Why does water in gasoline affect the proper running of the engine?

What are the most important things to inspect on an engine prior to flight?

Describe the function of a carburetor.

How would you adjust a carburetor if the engine was idling too fast? Name carburetor.

Give the approximate position in degrees of the crank shaft at the time the intake valve opens and when it closes on an airplane engine.

Explain the purpose of a condenser in an ignition unit.

Why is airplane engine oil of much heavier body than automobile engine oil?

After how many hours' flying should the following be checked: (a) breaker points in magneto, (b) spark plug gaps, (c) engine bed bolts and nuts, (d) valve clearances, (e) gas strainers, (f) oil strainers, (g) hose connections (oil and gas)?

Draw a diagram of either Stromberg or Zenith carburetor and trace the flow of gas through same.

Name four reasons for valve failure.

How would you locate a bad spark plug with the engine running?

Give seven definite reasons for an engine failing to develop power.

Make a drawing of a complete ignition system with which you are familiar and give reasons for the use of all appliances.

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Give several reasons why a motor might be hard to start and how you would remedy each case.

Make a drawing of a gasoline system from the tank to the engine.

How many times does a crankshaft revolve on an OX5 engine before all cylinders fire?

Give the firing order of two aviation engines.

What results from breaker points being too close? Too wide?

Explain why clearance is necessary between valve stems and rocker arms.

How would you determine whether the valves on an aviation motor need grinding?

Describe grinding valves, reseating valves, refacing valves.

Why are all fuel lines annealed before their installation?

What is the purpose of the safety gap in a magneto?

What is the speed ratio between camshaft and crankshaft on an engine with which you are familiar?

How is a condenser tested?

How do you determine proper clearance when fitting new piston rings?

How can you determine when the float level is too high in a carburetor? Name the carburetor.

What is the function of a scavenger pump in an aircraft engine?

What is the procedure for synchronizing magnetos?

If the firing order is not known, how would you determine it?

Give eight causes of ignition trouble and describe how you would remedy each.

Where should the booster be connected in an ignition system?

What causes engine valves to warp?

How would you check and adjust the valve clearance on two aviation engines with which you are familiar?

In cold weather, if an engine runs irregularly at cruising speed, but operates smoothly at wide-open throttle, what must be done to remedy the trouble?

Describe the process of installing new rings in an engine.

Describe the purpose of a Venturi tube in a carburetor.

What material should be used in gasoline lines?

How would you install a new main bearing? Name engine.

Explain, with diagrams, one complete cycle of a 4-cycle engine.

What is the difference between a dry-sump and a wet-sump engine?

What is the result of spark plugs having too wide a gap?

Describe how to check the ignition timing on an aircraft engine. Name engine.

What is compression ratio? Explain.

Describe all the ways by which it would be possible to change the mixture in a given carburetor. Name the carburetor.

What are three causes of loss of compression and how may each be remedied?

Name two different types of oil pumps. Describe them.

How can you tell when a valve is sufficiently ground in its seat?

Draw a diagram of a gear pump showing the flow of liquid.

AIRPLANES

For what purpose are compression members used in a wing?

What is meant by the following airplane terms: (a) overhang, (b) camber, (c) wing section, (d) parasite resistance?

How would you repair a broken steel-tube longeron?

What is meant by "wash-in"? "Wash-out"?

How would you tell whether or not the wood in a spar was dead or "brash"?

How would you check the stagger?

How would you check the alignment of a steel fuselage?

How would you repair an L-shaped tear in the fabric?

When should control cables be replaced and how may this be determined?

How would you determine that a ship was rigged too tightly?

What are the advantages and disadvantages of welding in airplane construction?

Under what conditions should doping not be attempted?

Give method of straightening twisted tail section. Name the plane.

How would you test the propeller for balance?

How would you check for the following: (a) incidence, (b) stagger, (c) dihedral?

What five things would you check to determine the cause of vibration in an airplane? Disregard engine.

Why are not cables used for internal wing bracing?

How would you correct for wing heaviness in a monoplane?

What would be done to an airplane so that it would not be necessary to hold right rudder for straight flying?

What kind of glue is used in aircraft manufacture and how is it mixed?

How would you check a fuselage to find out if it were in proper alignment?

Name five kinds of stress to which the various parts of an airplane are subjected.

Name two types of wing spars commonly used.

How are wires on a plane protected against rust?

What is the best way of inspecting wires for frayed or broken strands?

Explain briefly the procedure of propeller inspection.

Why is the fuselage placed in flying position when lining up?

Name three ways of correcting for nose heaviness.

How do you determine when the fabric of a wing is unsafe from age or exposure? Explain in detail.

Describe fully how a tubular repair is made at a station point in a longeron or motor bed.

How are tubular members protected from rust inside? Outside?

What is "dry rot"? How do you recognize it?

Explain the procedure of setting up and rigging a biplane.

Draw a diagram and name the parts of a wing panel.

Describe how you would repair a crushed leading edge of a wing in which several ribs were broken in front of the spar.

Describe how you would repair a badly crushed section of steel tube longeron.

Why should all wires be neither too tight nor too loose?

Explain how you would repair a cracked landing-gear fitting where welded to a longeron.

Explain how you would remove a propeller. Name the engine.

XUM

What would you do to inspect and repair an oil-shock strut that would not hold its pressure?

What are the advantages of balanced control surfaces?

What would you do to rerig a monoplane that had a tendency to turn to the left in flight?

What causes tail flutter on an airplane?

How would you remedy a rudder rubbing the elevators?

What is the purpose of decalage?

How would you repair a leak in an aluminum-gas tank?

How would you correct aileron control tubes and connections that were seriously worn?

How do you splice a flexible control cable?

How would you inspect the tension of inner-wire bracing of a wing that is in service?

Why is it important that the center section wires be of proper tension on an open biplane?

END

Airy Chat

(*Continued from page* 210)

Privette's Ford-motored ship was in this edition, and now we have a letter from Dick Privette that is decidedly interesting. Let's hear what he has to say—

Since the photo of my Ford "T" powered ship was published in POPULAR AVIATION, *I have received letters from practically all parts of the country.*

Now, Editor, here's my reason for writing. Let's find out what the boys have to say about the altitude attained by a Ford "T" powered ship. I'm going to try for some sort of record soon and I'd like to have some figures to shoot at. Hasn't somebody tried for the altitude already? I would like to hear from some "A" and "T" powered planes.

I am the only person in Louisiana having a Ford powered ship at present, so the inspector told me when he gave me my identification numbers.

You are not the only one that would like to get some authentic dope on the performance of Ford powered planes, Dick—so would we. Therefore, we will ask the owners of such ships to send performance data to Dick Privette, Abita Springs, La. He is a real enthusiast and an authority on lightplanes.

* * *

HERE'S some interesting news received from Wilson Palmer, 13829 Wabash Ave., Riverside Station, Chicago, Ill. This sort of letter is just the kind we would like to have more frequently. And this is what he says:

Perhaps you would be interested in hearing of an experiment which took place on January 25, at the Ford Airport, Lansing, Ill.

Lieut. McKee took up a Driggs Skylark equipped with two 'chutes on the center section, and at 2,500 feet stalled the plane and pulled the ripcord. Due to some defect in one of the pilot 'chutes, which operated by compressed air, only one of the large 'chutes opened. McKee was forced to release this 'chute from the plane and come down under his own power.

Later in the day, the plane was taken up for another attempt, and both 'chutes opened immediately. During the descent, the oscillations, which while not excessive, would have endangered the plane while landing. In order to avoid this, both parachutes were released and the plane landed under its own power.

In its present stage, the equipment is somewhat bulky and complicated, but these defects may be eliminated.

On June 28, 1931, I worked out an OX Waco in Harvey, Ill., just about 20 miles south of your office. Since that time I am still on crutches and I do not get around to the airports as often as I would like to. I get out to Ashburn occasionally and have been given the privilege of inspecting Maj Doolittle's Laird Super-Solution. It's some buggy.

I'm disgusted with some of the improvements (?) to our Municipal Airport, particularly with the fence which was erected. In the good old days—B. I.—before improvements—one could go and study the new types of ships and look over the planes in the hangar. Now, one needs binoculars just to see a ship land.

If any of your readers are interested in instruments or OX parts, or would like to try a hand at converting a fuselage into an ice boat or water sled, I'll be glad to talk business with them.

I think that POPULAR AVIATION *is one of the most interesting magazines published, and my partners on the Waco get it every month. Glad to hear that you have the largest circulation in this classification.*

I'm certainly not in favor of the Illinois law compelling all planes to be licensed. It's unfair to owners and home builders. However, it's passed and there's no use crying over spilled milk.

This is a whole lot of news from the Chicago district, and we thoroughly agree with Mr. Palmer on all of the subjects. Just what right has the City of Chicago to fence out the public from public property? If anybody should be fenced out, it should be the corporate flying concerns who are squatted on public property and taxpayers' property. It would be interesting to find out where all of the rental money goes—if these concerns do pay rent.

This is the good old Chicago stunt. Buy a piece of property at the taxpayers' expense, give a fake dedication to the public, and then turn around and chase the public off after it is rented to private concerns. I only wonder how much longer the public will be allowed to use the city streets.

Then, we have the other pest—the license laws—that do more damage to the aeronautical industry than a bombardment. If the various license laws do so much good, why aren't there fewer accidents?

* * *

SAY, fellows, have you looked over the first copy of PRACTICAL MECHANICS? If you haven't done this, I'll say it will be well worth your while to examine this new mechanical magazine. *Wow, what a bargain for* 10c!

* * *

THEY'RE airminded in Cuba, all right! We have received a most interesting letter from Mr. Ernesto Tabio, 25 No. 445, Vedado, Havana, Cuba, that outlines the various aeronautic activities that have taken place recently around Havana. Mr. Tabio is closely identified with aviation events in Cuba, and therefore there is real authority behind his statements. We now have a Cuban member in our family.

As I indicated you in my last letter, I will give you some information about the principal aviation events that occurred recently in my country.

The Pitcairn-Cierva autogiro arrived from Miami on the 24 instant. This was the first time that an autogiro has been seen in Cuba. It was piloted by Capt. Lewis Yancey. This flight was one of the longest made over water, and the last leg of the flight was from Key West to Havana. They left Key West at 1:30 and arrived at General Machado Airport at 3:11 p. m. Havana time.

This autogiro belongs to the Champion Spark Plug Co. Their manager in Cuba, Mr. Mackay, arranged some exhibition flights for the authorities, newspapermen, aviation clubs and for the Cuban Air Corps officers. I was given a ride over Havana in this machine and it behaved wonderfully.

She landed with practically zero forward speed and took off in less than 20 meters. The people of Havana were

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amazed with the "windmill", which they called the "Crab", "Spider", and other funny names.

Mr. Yancey afterwards will fly from Havana to Mexico. They will equip the autogiro with extra gasoline tanks to increase the cruising range.

I am enclosing to you apart, a copy of the only Cuban aviation magazine, "Aviacion". As you will see, I am in charge of the experimental section in which we deal with models, gliders and lightplanes. This is the first time in Cuba that an aviation magazine will deal with the junior activities, and I am very proud to be the first writer of this phase of aviation.

We have received the copy of the Cuban magazine, and it is well put up, but as the writer cannot read Spanish, unfortunately, he can only guess at its contents. We congratulate you, Mr. Tabio, on the success of your activities.

* * *

AND, on taking up the next letter, we find that this communication is from the pen of Mr. Robert D. Hawkins, Ashley, Ind., who tells us of his earliest experiences in aviation—notably as a spectator at a Jenny exhibition. This is a very welcome letter, and we are interested also in the turbo-engine which is described.

On page 30 of the August issue, I note an article about a pilot gliding in between the wires and fence in a small field. I saw the same stunt at a different place and in a forced landing.

It was the day after the Dempsey-Willard fight at Toledo, I forget the date, and suddenly the entire countryside around Wolcottville, Indiana, resounded with the roars of two OX5s in a couple of Jennys. Everyone was excited as the planes banked around overhead, and one could read the famous words "LOCKLEAR" on the lower wings.

I was only about nine or ten years old at the time and they were the first planes I had ever seen at close range. They circled awhile, and one settled down in a large level field of our neighbor's, that is, one of them settled down. The other went around until the first had stopped taxiing, and then swept in from the north side over the road and about ten feet high.

Up nearly to the phone wires, and he dived through the opening between the wires and the fence. As near as I can remember one of the shock cords on one ship had broken in the take-off, and was unwinding slowly on the flight to Chicago. As soon as the pilot saw it, he hunted a place to sit down and repair. I believe they used sash cord to repair it and a motorcycle tube to replace the one that blew out on the landing.

In a weekly newspaper I saw that a mechanic, or rather the Riemuller brothers at Wilmette, Ill., have built a 765 pound rotary turbine gasoline air-cooled engine, that is claimed to develop 900 h. p. in one bundle, without the aid of pistons, rods, valves, gears, or timing. The power mechanism is reported to be nine turbo vanes in a hollow flywheel mounted on a straight crankshaft.

Write to us again, and whether it is only a personal letter or material for the Airy Chat, we will be very glad to hear from you.

* * *

MOST of our Airy Chat readers are well acquainted with Ralph Pritchard, Mount Morris, N. Y., who has written letters for the A. C. before. This is a good strong letter, indicating pronounced views on national subjects, but unfortunately the letter is so long that we have been obliged to cut it at different points so that it will come within the space limits permitted for the Airy Chat. And here he goes—

I read your article (The Preparedness Fiasco) in this month's P. A. and it sure hits the spot. That is the kind of article your magazine has been needing for the past year or more. However, while it did hit quite a few spots, there are a couple you utterly forgot.

Now, why should Congress appropriate money for defense, when every cent saved goes toward the advancement of big business? For them a penny saved from defense is a penny earned. Of course, now and then, they have to satisfy somebody yelling from this or that part of the country, so they spend a little money foolishly.

How would anyone be so NUTS as to spend $100,000 for a bomber? How in the name of creation do those things cost so much? And the same applies to the Akron, her sister ship and her builders.

You have started one ball rolling by getting that petition up for an air reserve. But may I ask you if it will be of much use unless we have some planes for some of these to fly around, and things better than crates, planes that will make a little speed and that won't fall apart the first time they get a little speed.

Why don't we all, striving for the same end, join forces, get a large group of aviators and laymen thinking along the same channels as we, and if impossible to do anything else, force a referendum?

Let us do this now—now before it is too late. The next war is not far off, and it's going to take us one lengthy period to build our air forces up to anywhere near the size they're supposed to be.

I am sorry that all of this letter cannot be reproduced, but it contains the high spots as we see them. We think that this analysis is unusually good for a young lad who is evidently in his high school years.

* * *

AND now we turn up a letter from F. C. Plegge, Searcy, Ark., who has a wrecked Commandaire plane to sell. He will be glad to give a full description of the ship to anyone desiring to buy it.

* * *

AND say—what do you think of our cover this month? We believe that it is by far and away the best cover that we have ever put on this magazine.

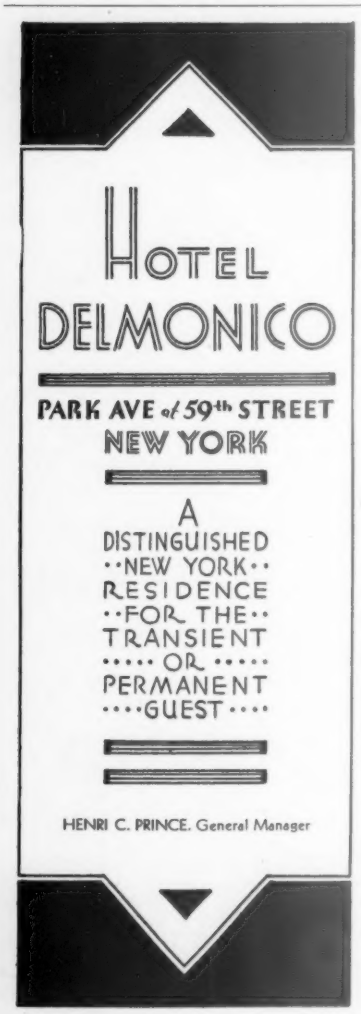
* * *

AND now, here is another letter from England by Mr. R. Landon, secretary of the Watford Light Aeroplane Club, 1f, Market Street, Watford, England. He encloses an interesting photograph of a revamped Sopwith Camel which we will reproduce in the next "Our Readers" department. Mr. Landon says:

Must compliment you on the production of a fine journal. Why not forget the past, though, and cut out the war stuff. I don't think any of the boys who served with the forces want to remember anything of it.

Met a lot of American lads up at Stamford, way back in '17—decent lot of blokes. Would like to hear from any of 'em. Several of them remain at Stamford—though unfortunately. Those old Jennies of yours used to fold up pretty considerable.

Here's something which may interest your readers. A Sopwith Camel fitted with a 45/50 Anzani which is still going strong. This club also has the late Harry Hawker's Sopwith Swallow, which is a "Camel" converted to a monoplane. Will forward a picture



of this shortly. Luck to everybody in these depressing times.

This old Camel certainly shows a long life, but I trust that it is in better condition than the majority of the post-war Jennies were in this country. The idea of this light aeroplane club is one that should appeal to amateur flyers in this country. Success and best wishes to the Watford Club and Mr. Landon.

* * *

IN PREVIOUS years, a wind tunnel was generally considered in the light of a luxury, to be owned only by governments and large corporations. However, we describe a simple and yet effective wind tunnel that can be built at a moderate outlay for schools and colleges as well as for private experimenters. This article is timely, and shows just another phase of aviation activity.

* * *

"WHERE is the center of gravity going to come on this ship?" is the question often asked by amateur designers of lightplanes. To know where the C. G. lies is an important matter, and in this issue we take up the matter in a very simple form, accompanying the text with easily understood diagrams.

* * *

AND here is the last paragraph for this issue. I hope it fits in snugly at the end of the column. And so, may all your take-offs end in happy landings, three-pointers if possible. Adios.

J. B. R.

Wally Beery

(*Continued from page* 220)

framed him and had an officer "arrest" him the next day. Beery was worried to death in fear that he would lose his pilot's license and he is now more careful to abide by the regulations.

OF COURSE, he has a good working knowledge of the airman's stock in trade—meteorology, motors, aerial navigation and so forth. In fact, he understands all there is to know from a civilian's standpoint about the business. He must, in order to fly the transcontinental route as he does. His plane is blue, with orange wings—no, not a fetish.

"Orange wings", he remarked, when asked about the color scheme, "are the best because they are the most easily seen from above if you have a forced landing and somebody's looking for you."

"Huh! Cheerful thought," commented Morris, "I guess I'd rather have my little roadster. They have to stop for signals and things on the streets after all. But then I suppose you'd use a parachute if anything happened."

"Nope—don't ever carry one," said Beery. "Parachutes aren't so hot, I think. Planes are a lot safer than people think. I like to fly on my back, then just cut the throttle down and pull her over."

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"IT MUST be a funny sensation—flying upside down," said Montgomery. "I've never flown except in a regular passenger ship."

"It is—except for looping when centrifugal force keeps you right in place. But you are strapped in, you know. In fact, a lot of fellows have flown upside down and never known it. In a fog, for instance, or flying over the sea on a clear day where blue sky and water look alike. The plane, particularly in a dense fog, can gradually edge over, and you're on your back flying along—"

"Don't the instruments tell you," asked Morris.

"Close attention to them will, of course. For instance, a sharp drop in flying speed for the same number of engine revolutions tells that something is wrong—perhaps you are upside down and don't know it. If you spit and it falls up, then you know."

"I looped a big Caproni once during the war," volunteered Hill. "I thought it had looped twice, but found out afterward that it was only once. Big planes used to be deceiving as the dickens."

"Well," said Beery, "it won't be long now until we won't have to worry about anything but landing and taking off. Planes will all be flying in regular lanes by radio control—they're starting it now, and with the Sperry gyro and other new inventions there won't be much chance to go wrong. Except, maybe, in storms. The one thing that really scares me is to fly into a storm and see ice beginning to form on my cables and flippers."

"I had the same experience in the army," grinned Hill. "It's a grand and glorious feeling, all right. Another is air pockets."

"Yep—try crossing the Grand Canyon. Down you go, and then up again. Air pockets are nothing but up-and-down air currents, and the air rushes in and out of the Grand Canyon like water across a ditch. All a fellow has to do is to sit tight. If he tries to pull out of it, he's liable to stall and go into a spin. Spins can be cured, but if you land in the Grand Canyon you can't get out again—except by taking the plane apart and carrying it up."

"I thought spins were dangerous," interjected Bob Montgomery.

"Naw, only for amateurs. When they examined me for a transport license they made me spin five times and pull out of it. Modern planes come out easily. Just set the rudder the other way, or dive with the controls neutral, and then pull her out of the dive. Of course, flat spins—where the plane stays level and spins — usually can't be stopped. But they're rare and caused by a defective plane. Almost any normal spin is all right."

You're right, Wally. The only spins in "Hell Divers" which were impossible to correct were those in which the planes had crashed together or were minus a wing.

BEERY regards flying as the greatest sport in the world, and as one of the safest pastimes. He answers any statement about a plane wreck by quoting accidents to automobiles in the past year—and grinning. He keeps his own plane, his own mechanic and is up every time he hasn't a picture role to keep him in the studio.

"The greatest factor in the advancement of aviation was the Guggenheim Foundation," says Beery, "and aviation's greatest press-agent is Lindbergh. I don't think he ought to fool around with gliders so much though. They're all right, but never will be useful except for dropping freight or passengers, perhaps, from a big plane at small stations." But, Wally, don't forget the many young enthusiasts who glide at every opportunity all over the country and love it.

Beery's closest competitor for sportsman pilot honors, at the western film colony, is Clarence Brown, the director, who also has a transport license. Paul Dickey, playwright and M-G-M scenarioist, was an aviator in the Marine Corps during the war, and still flies, but not so often. Hal Roach is another owner-pilot and so is Ben Lyon and Billie Dove. Ann Harding is taking lessons. Hill, the director, a captain in the Signal Corps, flew in Italy and France, but seldom does it nowadays himself, preferring to sit behind a pilot.

"But then, he's just been married," said Beery, "and I guess Frances Marion, his wife, won't let him cut up the way he used to."

END

Transport Pilot

(*Continued from page* 244)

On the return trip, flying mail, the regulation "zero" outfit is in order. After the clothing detail has been taken care of, I walk over to the plane and receive the mechanical O.K.

I climb in, rev the motors a few times to see that they function perfectly and then note that it is time to taxi to the passenger station. Rules specify arrival at the station five minutes before departure. There, and with the passengers all comfortably seated, I get the "take-off flag" from the guard.

Once in the air, I automatically glance over everything a few times and then switch on the radio to "take". This operation will give me the reports of all stations within my range. If I want any specific information I simply switch the radio to "broadcast", ask for it and then turn it again to receive and listen. The microphone is located to my left and within easy reach.

Operating the plane, listening to the dispatches and making my own reports to the stations along my route three times an hour, keeps me constantly occupied. The co-pilot sees to the comfort of the passengers and I very rarely have a disturbance.

I now sight Moline dead ahead and land at 5:25. Fifteen minutes are allowed for the change of mail and baggage. At 5:40 we are in the air again, with Kansas City the next stop. I cut across the Mississippi into Iowa for a short stretch and then across the Des Moines river into Missouri.

FROM then on, the towns pass by in procession. At dusk the pin points of light turn on until the town is a white space in a black desert at night. We are in Kansas City at 8:15, having covered a distance of 457 miles in four hours and fifteen minutes.

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I have my dinner in Kansas City and am ready to take off the mail plane at 2:10 a.m. The night trip in a fast mail ship is the most enjoyable to me. I often wonder what the people below, most of them snug in bed, think of as they hear the roar of my motor in the sky. I suppose they look at their clocks and say, "On time again!" There is an additional source of revenue I've never thought of before—we could charge them for time-signal service.

Miles away from Chicago, providing the visibility is good, I spot the Lindbergh beacon and realize that another trip will soon be over. The airport takes shape below the plane and in just a few minutes I set the wheels on the ground.

People have asked me whether it is difficult to land at night. Over the larger cities the smoke sometimes makes for poor visibility and a little more care in landing. Sometimes the weather happens to be bad west of Chicago, but clear here. I then fly by instruments and follow the radio beacon into the Chicago airport.

All in all, when the visibility is fair, night flying is a simple enough job and one that merely requires a good deal of practice.

I HAVE to laugh every time I think of taking care in landing. When I was on the Chicago-Cleveland route, I ran into one of these peculiar summer storms. You know the kind, rain one minute—clear the next. I was flying a Boeing 95 mail plane and, at that time, the spark plugs and wires were not covered to prevent water from drowning the motor in a heavy rain fall. I left Chicago at 8:30 p.m. east bound for Cleveland and experienced one rain squall after another.

The motor began to miss and backfire every time I ran into rain but just as soon as I came into clear weather, the cylinders would begin firing in perfect order. Well, a few miles out of Toledo, I ran into one of the heaviest rains I've ever known. The water came down in bucketsful and the motor began to lose the firing of one cylinder after another.

At last, one cylinder was all that was left and I heard it snorting for all it was worth. I knew I was in a tough spot. I had been flying close to the ground so I couldn't jump with any degree of safety. Since a flare is practically useless in a heavy rain, I could not light the ground for a landing. I was in this plane with the heavens above, the earth below and a sincere prayer on my lips.

I could see the dim lights of some town below me and, by that time, I was skimming the tops of the tall trees. I can't tell you how impossible everything seemed to me. This one cylinder was of no use, my flares and parachute were laughing at me and I was hanging between the devil and the deep blue sea.

AT the peak of my feelings, I ran out of the rain. It surprised me so much that I sat glued to the stick, wondering what was going to happen next. Without warning, one cylinder after another warmed up and began firing. Sweeter music I never hope to hear. I landed safely at Toledo a little later and pinched myself to make sure I was alive. A boy caught in the act of stealing jam from a pantry couldn't have looked more at loss than I did when the rain stopped.

People have asked my wife what she thinks of my flying. To tell the truth, she accepts it without any worry or fear because she realizes how safe flying has become in this day and age. By the way, isn't that just about the best selling talk for aviation you know of?

END

Radio

(*Continued from page 226*)

inch an hour—that's how slowly I tuned that dial and the answer was—nix.

I finally found a knob that looked like it might have some meaning. I twisted this with a vengeance. I was again approaching the point where I could have spanked the first kilocycle that I could catch. The knobs on the set looked like they were laughing at me, so I twisted all of them and—.

". . . Ribber stay away from the door," said the radio.

Now if I could just find the gink who wrote this song I'd feed him to the first hungry prop I could find—a nice big steel one. And now won't some kind congressman or senator pass a law that will keep the river away from that guy's door? Every time I turn the dial that song hits me in the face and it seems to be all over my short-wave set.

I called the field again and asked the radio man what was wrong. I told him about the "river" and the "prisoner" and the static. Then that big stiff told me that some kilocycle married a meter and the children from this union did not know whether they were kilocycles or meters so they went into a huddle and the result was static.

Can you imagine that yahoo telling me that bed-time story?

Along with the above information, this bimbo informed me that the airlines change their frequency in the evening, and after I had hung up the phone, I wondered what the heck a "frequency" was. I was getting to the point where I wished I had kept up on my math. Another phone call to the field partially straightened me out and I went back to the set with new whim and wigor.

I TREATED that dial with the same respect that I would a stick on a 300-m.p.h. pursuit job. I poured the can to it, I cut her to idling, I twisted gadgets, I screwed in the hootenanny and the only thing I heard was the rain on

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the roof. Radio—bah, and several dings.

". . . and this is Christ Church, New Zealand—Station VK3ZC—signing off," said my radio rather quickly as if it were afraid I was not going to give it a chance to strut its stuff. After this I could understand why radio men have a vacant stare in their eyes and show no surprise at anything that takes place.

Radio stock again took a climb. Hot dog, New Zealand! Now, ain't that somepin'? Still that wasn't what I wanted and I tuned some more. I wanted airplanes and I meant to get them if I had to climb right into that speaker and go to one on the tail of a kilocycle. I wanted to listen to some of these night flyers and see what they were doing. I finally twisted the old throttle knob and—.

". . . Oakland calling Ray Little." And then, "Go ahead, Little," said this sweet little radio.

I again climbed to the floor and put my head into the speaker.

"Hello Oakland—Over Truckee," said this old timer, Little.

Oakland carried on an office conversation for a few minutes, then clicked off and my radio became silent.

"Oakland calling Evans—go ahead Bill."

BILL answered like he had a mouthful of hot mush, but it may have been a hot kilocycle. Oakland told him to come again—he could not "read" him. Huh, that was nothing, neither could I. Somebody changed a meter or something into a kilocycle and Bill's voice sounded human once more. He wanted weather at Reno as he was due in there in thirty minutes. Oakland called Reno and the Reno operator gave Bill the last weather report he had.

Somebody else along the line poked in their two-bit's worth and told Evans that the spot where he was flying had a ceiling of five thousand feet. Evans told the two-bit guy that he was flying blind and the radio man answered, "Impossible." Now what I want to know is—who's right—the guy who's flying through the blind weather or the radio man?

It's a good thing they don't allow cussing on the air, or from what I know of old man Evans, one radio man would have had his ear-drums singed. However, both men shut up and everything was—static. (This might have been the thoughts of old man Bill Evans.)

Five minutes later Oakland called Herb Kraft to tell him that his best flying altitude was three-thousand feet. Herb was on his way up from San Diego and had just gotten over the Ridge. Kraft said he had tried all the altitudes and found six thousand the best. The radio man insisted that three thousand was better. Now who's right? There's going to be a good job some day in this radio game for a referee to sit in and give decisions on these minor discrepancies.

Oakland called Burr Winslow, but Burr didn't answer. Oakland called several times and finally Winslow came in with a bang.

"Winslow calling Oakland—just got over the hump. Wings loaded—no visibility—expect to get in on time."

"Oakland to Winslow." Again Winslow seemed to have other duties just at the moment. Finally in a very faint and indistinct voice came:

"Go ahead, Oakland"; but it sounded like, "Soak your bread in oakum."

Oakland just wanted to ask Winslow if he had an office pouch with him from Salt Lake. Also, if he was bringing a coat that was too small for some palooka that was to be swapped with another palooka's. Now I ask you, isn't this a swell idea, break in on a guy flying through a snowstorm, with loaded ship on his hands, to ask him a lot of fool questions?

Winslow said just plain "No"; but he didn't fool me any. I have a hunch he cut his key on the last of the sentence.

"All radio stations stand-by," said my radio.

Now this standby order, during the kind of weather we've been having on the Pacific Coast, is almost as good as an S.O.S. Something was going some place to happen. I was just figuring how I could take the cloth from the front of the speaker so as to get in further when the radio shouted:

"Oakland calling Little."

SO that was the reason for the standby. Ray Little was on the spot somewhere. Oakland repeated the call over and over again. All planes on the Coast were down and the mail was being trained. Little's was the last ship in the air and it seemed that no station had heard from him for several minutes. Other stations along the line sent out the call to Little.

A check-up of the ground stations by Oakland showed that Ray Little was carrying on through the worst snowstorm in several years. He had no passengers—just mail—and Little is one of the old-timers who hates to put mail on the train that's supposed to go by plane. Out of the ether came Little's voice:

"Little Calling Oakland—motor trouble. Just left Emigrant's Gap and will try to make Blue Canyon Field. Following down the railroad track—go ahead, Oakland." When it comes to pure, unadulterated grit, this boy has plenty. I followed him all the way to Blue Canyon Field by radio and I surely wished him all the luck in the cock-eyed world.

He was hopping a single motor job over some of the wildest country in the United States and through one of the worst snowstorms in twenty years and how that boy was flying. No losing his head and putting down at the first signs of trouble. That guy uses his head for something besides a hat rack.

Every radio ground station on the Coast dug up all the weather they could for this pee-lot. The standby order opened all the keys and a good many people were wishing this boy well.

"Reno calling Little. About eight inches under you in the valley, Ray. Blue Canyon Field covered about the same thickness. Almost impossible to make decent landing. Go ahead, Ray."

"O. K.," said Little.

"O. K.," says this guy. Snow, mountains, sleet, midnight and a bum motor; and he says O. K.!

Five minutes later a very faint voice was heard. Again the kilocycles slipped.

". . . motor quitting. Going down into Blue Canyon Field," said Little. He meant that he hoped he was going into Blue Canyon, for in a snowstorm a man flies mostly by-guess-and-by-gosh. One hour later I heard them announce from Reno that Little landed O. K. in Blue Canyon and that the mail was being trained. Now, can some of you youngsters realize that when God made these mail pilots, that he made men?

If you have made aviation your vocation in life, a short-wave set will teach you a lot about big-time flying, and I don't mean maybe. It will show you just what these mail men go through when they bring the mail through in the winter time. There's enough thrill in one of these sets to keep you going for the rest of your life.

Well, I can see where another aviator has gone wrong, or otherwise. The writer always thought that radio was a disease, and to be shunned along with wood alcohol and carbolic acid (when used as a drink), but that was several weeks ago. Since then, one of these kilocycle bugs have eaten into me, and I feel that it won't be long now. Oh, woe is me! Move over some of you "hams" and let a little bacon climb in.

END

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Warplanes

(*Continued from page* 230)

strip off the top wings in precipitate dives.

On several occasions, the latter defect endangered the lives of American pilots who flew the Type 28. Moreover, it cost us more than one victory over the enemy.

The Type 28 was the last of the famous Nieuport line to be flown against the enemy. Appearing in late 1917, the ship was in production a few months later and the American Air Service bought some because they couldn't procure any Spad single-seaters at the moment. The 94th Squadron, the first American pursuit outfit to fly over the front, used the 28 Nieuport. So did the 95th, the 27th and 147th Squadrons.

THE Nieuports that preceded the Type 28, had Vee-shaped interplane struts and very narrow lower wings. The Type 28 had parallel wing struts, wide lower wings and a well-braced undercarriage. The motor was a 160 h.p. Gnome Monosoupape, with provision for firing either one, three, five, seven or nine cylinders. Thus, if the pilot wished to taxi, he used only one or three cylinders.

The Type 28 climbed fast, maneuvered well and had a top speed of 123 m.p.h., which was only 7 miles per hour slower than a Spad 13. Until June, 1918, when the Fokker D-7 appeared on the front, the Americans mounted on the 28 Nieuport, were quite successful in combats with German pursuit ships. The 28 Nieuport, though ill-equipped and dangerous, was a much better plane of its type than the A. R., the Spad 11 or the Sopwith 1½ Strutter were of theirs.

Much has been written on the subject of these three ships, but little has been said about them comparatively. The great maneuverability of the "28" probably glossed over its glaring deficiencies in other respects.

The mighty pursuit ships of the war were the Fokker, Nieuport, Albatross, Spad, Camel and S.E.5. And of this lot none was mightier than the Spad. The Spad 7 came first, the type that Guynemer flew to fame and then to his death. Next in line was Spad 13, the standard equipment of American pursuit squadrons after the 28 Nieuport was discarded.

It's true that two American squadrons, the 17th and 148th, attached to the British, flew Camels. Just before the Armistice, however, these two squadrons were ordered to rejoin the American army and fly Spads.

In many constructional details, the Spad 13 was like the Spad 11—the two-seater already described in this article. Spad 13, being a single-seater, was considerably smaller and more compact. It had a very narrow pilot's seat, a characteristic of all Spads. Unlike the Type 11 the inner interplane struts were divided.

The 13 was powered with a 220 Hispano-Suiza motor. Its overall span was 26 feet 3¾ inches. Its length was 20 feet 4 inches. The wings were of the wafer type—very thin—for this feature was supposed to increase the speed.

The machine's high speed was 130 m.p.h. It climbed rapidly, eclipsing the Fokker D-7 in this respect. The service ceiling was just above 18,000 feet and the landing speed was between 60 and 70 miles per hour.

In performance, the Spad 13 and the Fokker D-7 were almost matched. The Fokker maneuvered a little better, but the Spad outclimbed and outdived the Fokker. Their speed was a standoff.

One peculiarity of the Spad 13 was the strong, almost vertical, metal tail skid, which dug in tremendously when landing and checked the forward speed most effectively. This was a vital safeguard, for the Spad hit the ground at high speed, and most pilots landed them well in excess of stalling speed because of the machine's tendency to sink rather than float in a glide.

The Spad was the strongest plane of the war, and it looked the part. Pilots have been known to dive them 15,000 feet vertically with full motor.

Many of the Spads used by the Americans had second-rate motors. Equipped with a real Hispano-Suiza, the Spad was dependable and very popular with war pilots.

Night pursuit was the outgrowth of the Allies' efforts to protect London and Paris against night bombers. By 1918, night pursuit became a regular part of the British program, and one British outfit engaged in this work brought down over twenty German bombers. This unit flew the Sopwith Camel, and their success led the American army to send out in October, 1918, one night pursuit squadron, the 185th, equipped with Camels.

Some adequate protection against enemy night bombers was almost a necessity, because the Germans did the principal part of their bombing at night and they operated extensively over the American sector.

THE Sopwith Camel was the most famous, the most widely used and the most successful of all British pursuit planes. Appearing in 1917, it enabled the British to wrest the supremacy of the air from the Germans who were then flying the Albatross and the Fokker triplane.

It is said that the Camel was the first English pursuit machine to be armed with two fixed machine guns firing through the propeller, a practice that soon became universal for both Allied and enemy machines of the single-seater type.

The fittings of the two machine guns, mounted on the fuselage, made a decided hump. This peculiarity, some claim, was responsible for the name "Camel" applied to the ship. Others

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contend that the combination of dihedral angle on the lower wing, with flat upper wings, produced an optical illusion so that when the Camel was in the air it appeared to have a hump on its back.

The Camel was a small compact machine with the upper plane staggered forward and no sweep-back. The single struts of spruce were streamlined, as were the landing and lift wires and the body. The latter was a girder type with four longerons and a rounded top.

The ship was equipped to carry four small Cooper bombs which were released by Bowden cable.

The guns were Vickers with a telescope sight between them. The power plant consisted of a 130 h.p. Clerget. The fuel supply, carried in a large pressure tank and a smaller gravity tank, was sufficient for 3½ hours flight.

The pilot's seat, placed against the motor, was underneath the top wing. To improve the pilot's view, a rectangular window was cut in the top plane center section. An ingenious plate device was inserted in the window edges to lessen the annoyance of air flow. The rear of the center section was trimmed away to make it easier for the pilot to get in and out of the cockpit.

When the Camel first appeared, it would outclimb, outmaneuver and outstrip any plane on the front. Several machines excelled it in a dive. Capable of the most extraordinary evolutions in the air, the Camel was the finest maneuvering ship of the war. British pilots in the Camel even managed to hold their own against the renowned Fokker D-7, a much faster plane than the Camel that could outdive it and had excellent maneuverability as well.

The Breguet was a French plane. The 14-A-2 was for reconnaissance work while the 14-B-2 was for bombing. The reconnaissance machine had a higher ceiling than the bomber, was slightly faster, climbed more rapidly and had less wing spread. In other details the two types were essentially the same so one description will suffice for both.

THE Breguet had a metal frame—aluminum tubes riveted with welded steel tube sleeves. The three sets of struts that formed the landing gear were streamlined aluminum tubes as were the interplane struts also. The spars were made of aluminum, and the tail, rudder and elevator frames were made of thin steel tubes.

The motor was a twelve cylinder, "Vee" type Renault that developed 300 h.p. at 1500 to 1600 r.p.m. The aluminum radiator in the nose was divided in the center so that each row of cylinders had its own cooling system and pump. The two-bladed propeller was driven direct.

There were two gravity tanks behind the motor and a small auxiliary tank in front of each carburetor. In ascending the auxiliary tanks supplied the gasoline. The machine carried fuel for 2½ hours flight. The fuel gauges which operated electrically were quite handy.

The Breguet had a starting magneto, and the windshields were of Triplex glass. Under the seats of both pilot an dobserver were large view traps, which the observer opened or closed by a cable. The observer also had isinglass windows in both sides of the cockpit.

The rear guns were mounted rather high up on a turning and raising ring which encircled the observer. This arrangement permitted an excellent firing range forward. The pilot's fixed gun, placed on the left side, was operated from the cam shaft.

ONLY the top wings were fitted with ailerons. That section of the lower wing behind the rear spar was hinged so that it could be pulled downwards by twelve rubber bands attached to the ribs. By adjusting some screws the tension of the bands could be regulated, thus changing the aerofoil until the easiest control considering the load and speed was obtained.

The machine was rigged for night flying, with position lights on the outer struts and searchlight mountings under the leading edge of the lower planes.

The high fuselage, the exhaust pipe that extended above the upper wing and the right angle rudder with sharp rounded stationary fin, gave the Breguet a very distinctive silhouette.

The Breguet was an excellent plane and far superior to the De Haviland 4 for both observation and day bombing. The Breguet climbed well, maneuvered satisfactorily, carried a heavy load at high speed and was strong enough to withstand precipitate nose dives.

The 96th—the first American day bombing squadron to go into action—used the Breguet. They continued to use it until the end of the war. The 9th Squadron, our only night reconnaissance unit, also flew the Breguet.

The DH-4 was the only battle plane used by Americans that was built in the United States. Of English design, the DH-4 was changed slightly to accommodate the Liberty motor.

The DH-4 has been flown so much in America that everybody is familiar with it. As a cross-country bus, the DH-4 was a huge success. As an observation plane over the Western Front it was mediocre, being inferior to both the Breguet and the Salmson. As a day bombing machine it was terrible. Considering the ease with which it caught on fire in combat, perhaps the worst of the war.

The first flight over the front in a DH-4, fitted with Liberty motor was made on August 2, 1918, by members of an observation squadron. Six of America's thirteen observation squadrons and three of her four day bombardment squadrons used the DH-4.

END

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